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STACKS - S.B.T.



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# Highway Safety Literature

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**GPO:** Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. **Give corporate author, title, personal author, and catalog or stock number.**

**Reference copy only:** Documents may be examined at the NHTSA Technical Reference Branch or borrowed on inter-library loan through your local library.

**See publication:** Articles in journals, papers in proceedings, or chapters in books are found in the publication cited. These publications may be in libraries or purchased from publishers or dealers.

**SAE:** Society of Automotive Engineers, Dept. HSL, 400 Commonwealth Drive, Warrendale Pa. 15096. Order by title and SAE report number.

**TRB:** Transportation Research Board, National Academy of Sciences, 2101 Constitution Ave. N.W., Washington, D.C. 20418.

**Corporate author:** Inquiries should be addressed to the organization listed in the individual citation.

## **ABSTRACT CITATIONS**

# SAMPLE ENTRIES

## FORMAT OF ENTRIES IN HIGHWAY SAFETY LITERATURE

NHTSA accession number ----- HS-013 124

Title of document ----- **MAXIMUM BRAKE PEDAL FORCES PRODUCED BY  
MALE AND FEMALE DRIVERS**

Abstract ----- The object of this research was to obtain data concerning the maximum amount of brake pedal force that automobile drivers were able to sustain over a period of ten seconds. Subjects were told to apply the brakes in the test car as they would in a panic stop, and to exert as much force as possible on the pedal over the entire ten second test period. A total of 84 subjects were tested, including 42 males and 42 females. The results indicated that there is a wide distribution of values which characterizes the pedal force that the subjects were able to generate. Male subjects produced generally higher forces than did females. Over half the women tested were unable to exert more than 150 lbs. of force with either foot alone, but when both feet were applied to the pedal, force levels rose significantly.

Personal author(s) ----- by C. R. VonBuseck

Corporate author (or author's affiliation) ----- General Motors Corp.

Publication date; pagination ----- 1973? ; 18p

Supplementary note ----- Excerpts from Maximum Parking Brake Forces Applied by Male and Female Drivers (EM-23) BY R. L. Bierley, 1965, are included.

Availability ----- Availability: Corporate author

NHTSA accession number ----- HS-018 924

Title of document ----- **NATURAL FREQUENCIES OF THE BIAS TIRE**

Abstract ----- The lowest natural frequencies of a bias tire under inflation pressure are deduced by assuming the bias tire as a composite structure of a bias-laminated, toroidal membrane shell and rigorously taking three displacement components into consideration. The point collocation method is used to solve a derived system of differential equations with variable coefficients. It is found that the lowest natural frequencies calculated for two kinds of bias tire agree well with the corresponding experimental results in a wide range of inflation pressures. Results of the approximate analysis show that the influences of the in-plane inertia forces on natural frequency may be considered small, but the influences of in-plane displacements are large, particularly on the natural frequency of the tire under low inflation pressure.

Personal author(s) ----- by Masami Hirano; Takashi Akasaka

Journal citation ----- Pub! Tire Science and Technology v4 n2 p86-114 (May 1976)

Publication date ----- 1976; 6refs

Availability ----- Availability: See publication



HS-022 512

## **PRODUCT SAFETY--A PRIME CONSIDERATION IN EXPANDED DESIGN CRITERIA FOR ENGINEERING EDUCATION AND PRACTICE**

Design criteria for engineering education and practice have been expanded as a result of increased products liability litigation, standards development, and Governmental regulations. In the current design legal climate the traditional design procedures and criteria (function, cost, manufacturability, marketability) are still valid. Today, however, product safety (products liability) considerations have to be an integral part of the entire design process as well, not only including the function and safety phases but also in the cost, manufacturing, and marketing phases. To specifically address the product safety failure (or malfunction) problems which have contributed significantly to the existing products liability situation, current design procedures must emphasize the following factors: safety that is associated with all modes of the design usage; failure analysis, so that if failure cannot be prevented, it can be predicted and its consequences controlled; and documentation associated with the evolution of the design that is developed in such a way that it can satisfy the nontechnical but involved public (e.g. a jury, attorneys) as to the rationale behind the design and the decisions and trade-offs that had to be made.

by Leo C. Peters  
Iowa State Univ., Mechanical Engineering Dept.  
Rept. No. SAE-770619; 1977; 7p 4refs  
Presented at SAE Mississippi Valley Section Meeting, Moline, Ill., 28 Apr 1977.  
Availability: SAE

HS-023 464

## **THE EFFECTIVENESS OF TRAFFIC SAFETY MATERIAL IN INFLUENCING THE DRIVING PERFORMANCE OF THE GENERAL DRIVING POPULATION. AN ABSTRACT**

A study to determine if traffic safety materials are effective in reducing subsequent accident and conviction of the general driving population (licensed California drivers) is summarized. A second objective of the study was to determine the effectiveness of different topics covered by the materials, and a third objective to determine if materials tailored for specific age-sex groups are more effective than nontailored materials. Seven traffic safety booklets were developed. Five booklets contained educational material frequently used in traffic safety campaigns; one contained educational material of value to all drivers, each of the other four was tailored to drivers of a particular age-sex group (drivers under 26 years of age, male drivers 26-54 years of age, female drivers 26-54 years of age, and drivers 55 years of age or older). A sixth booklet contained material emphasizing the emotional factors in driving. The seventh booklet concentrated on highway signs and street markings. Results indicate that the materials were not effective in reducing subsequent six-month accident and conviction frequencies. In addition, they indicate that neither the topic nor the tailoring of the material had any effect on subsequent driving record. Finally, age and sex of the subjects did not moderate the effect of the material on subsequent driving record. It is recommended that the California Dept. of Motor

Vehicles not incorporate these safety materials in any of its ongoing operations. The Department's traffic safety dollars would be more wisely spent on developing and evaluating countermeasures other than traffic safety materials of the type evaluated.

by James W. Anderson  
California Dept. of Motor Vehicles, Office of Prog. Devel. and Evaluation, Sacramento, Calif.  
HPR-PR-1-(II)-B0155  
Rept. No. CAL-DMV-RSS-77-57; HwyRR-B0155; 1977; 14p 6refs  
For complete study, see HS-022 447.  
Availability: NTIS

HS-023 465

## **THE RATIO MAP: A TECHNIQUE FOR HEADLAMP COMPARISON**

Until the ratio mapping procedure was introduced, it was not possible to compare the relative output from two headlights or configurations on a given target surface without manually overlaying their contour plots; and it was quite difficult to demonstrate, for example, a 2:1 relationship between headlights without computing ratios at each point in the mapping plane. Thus, the ratio mapping technique was developed as a means of measuring relative headlight performance for different types and groupings of headlights. Two particular ratio mapping programs and their use are described. The first program, module ISC of the RATIO program library, constructs the ratio map for given pairs of headlight intensity maps. The second program, module MAIN3 of the VIEW program library, constructs the ratio map for given pairs of headlight illuminance maps, where the illuminance was mapped over a vertical plane situated at a fixed distance ahead of the vehicle in which the headlights reside. Two appendices give source listings for the computer programs and their associated modules, and demonstrate typical output from a sample program in each case. A brief comparison of the two sample mappings is offered in order to illustrate the interpretation of the ratio map.

by Ann L. Harrison  
National Res. Council Canada/National Aeronautical Establishment, Ottawa, Ont., Canada  
Rept. No. LTR-ST-972; 1978; 67p 2refs  
Availability: Corporate author

HS-023 466

## **CAR SAFETY FOR INFANTS: EFFECTIVENESS OF PRENATAL COUNSELING**

In a middle-class, pediatric office setting, car safety counseling was provided to 16 primigravida women during a prenatal interview; a control group of 19 women received no counseling during a similar interview. Forty-two percent of noncounseled mothers and 69% of counseled mothers were, at the time of the six-week well-child visit, using safe restraint systems for their infants. This 40% baseline figure is higher than the 9% that Scherz reported in a somewhat comparable study involving eight-week-old infants. This probably reflects either a general increased awareness of car safety practices in the three years separating the two studies or differences in the

type of patients. The prenatal counseling was felt to be of value. A single brief discussion of car safety yielded a moderate increase in infants traveling safely by six weeks. Further "booster" discussions during the first few pediatric visits might increase compliance even further. However, the observation that few infants were transported in the back seat and that some had not been correctly positioned in approved infant seats indicates that counseling must go beyond mere selection of safe restraint systems. While anticipatory guidance is recognized as a major component of pediatric practice, without systematic planning, car safety counseling will continue to be haphazardly provided. The prenatal period is logically an ideal time to encourage parents to provide safe automobile restraints for their children. While prenatal visits are considered "luxury items" in pediatric practice, the involvement of pediatricians or nurse clinicians in childbirth education courses would seem to be an alternative and equally effective method of providing such counseling.

by Harold A. Kanthor  
Publ: Pediatrics v58 n3 p320-2 (Sep 1976)  
1976; 6refs  
Availability: See publication

HS-023 467

### THE VISUAL PERCEPTION OF ACCELERATED MOTION

A series of experiments was conducted to investigate how subjects perceived changes in the rate of motion. Five separate experiments were performed with the use of filmed stimulus material and a variety of response measures, including both categorical judgments and reproduction techniques. Findings of this study include the following: the smaller the ratio of terminal to initial velocity, the less frequent the judgments of acceleration or deceleration; deceleration is significantly easier to perceive than acceleration; perception of acceleration is facilitated when the velocity of a lead-in segment was the same as the velocity at onset of motion; perception of acceleration and deceleration is facilitated by a short tunnel centered in the motion path; and instantaneous changes in velocity are much more easily perceived than gradual changes. A one-event model for the perception of motion change in which there is a continuous interplay between earlier, later, and interpolated motion segments is favored over a two-event model in which earlier and later segments of velocity are compared.

by John Schmerler  
Publ: Perception v5 n2 p167-85 (1976)  
1976; 19refs  
Availability: See publication

HS-023 468

### TESTING OF EMERGENCY AND EVASIVE ACTION DRIVING MANEUVERS

Methods for testing the level of evasive action driving skills exhibited by persons who take emergency and evasive action driver education, both before and after instruction, are described. The instruction is based upon a modified curriculum, the original of which was developed by General Motors Corp. at the Milford, Michigan Proving Grounds. Although the maneuvers used for testing are based upon the curriculum employed by Eastern Illinois Univ., the methodology is general-

ized and applicable to the same or slightly modified maneuvers. The following maneuvers are described for testing: serpentine, emergency braking, controlled braking, backing, spatial perception, skid control, and off-the-road recovery. An appendix contains descriptive material which is given to participants to be tested. Pilot testing has been conducted with six drivers from Eastern Illinois Univ. and 12 firemen from Springfield. Full-scale testing will begin with two police training programs. As a result of the planned testing of approximately 80 drivers, further refinements will be made.

by Richard A. Raub; Daniel J. Bolin  
Illinois Dept. of Transportation, Div. of Traffic Safety;  
Eastern Illinois Univ., Dept. of Health Education  
1977; 44p 3refs  
Sponsored by Illinois Dept. of Transportation, Div. of Traffic Safety.  
Availability: Eastern Illinois Univ., Library Services,  
Charleston, Ill. 61920

HS-023 469

### SEAT BELT LEGISLATION: AN END TO CRUEL AND UNUSUAL PUNISHMENT [SASKATCHEWAN, CANADA]

Saskatchewan's (Canada) compulsory seatbelt usage legislation came into force on 1 Jul 1977, but motorists in the province were granted a three-month grace period to allow for their adjustment to the new law. The law applies to the driver and front seat passengers who occupy a seat serviced by a seatbelt assembly. Various exemptions to the law include the following: persons involved in driving a vehicle in reverse; persons holding a valid medical certificate stating reasons exist which make a person unable to wear a seat belt; and persons engaged in work requiring leaving and re-entering a vehicle at frequent intervals, and traveling at a speed not to exceed 40 kph (24.86 mph). The driver and all front seat passengers over 5 years of age or who weigh more than 50 pounds and do not qualify for an exemption, and are traveling in a car equipped with seat belts, must use the seatbelt assembly regardless of the model year of the car. The Saskatchewan Safety Council realizes the need for back seat passengers to use seat belts as well as front seat occupants, and have signified their support for total coverage under the law. Amendments of this nature will be made once the government is satisfied the public accepts seat belts as a concomitant of vehicle use. With respect to public acceptance, Saskatchewan Safety Council figures showed 68% supported mandatory seatbelt legislation in the province (Apr 1977 report). A national advertising campaign was launched in 1975 by the Federal government with effective material the provinces have agreed to incorporate into their promotional efforts showing how seat belts save lives and reduce injuries.

by T. W. Wakeling  
Publ: Saskatchewan Law Review v42 p105-15 (1977)  
1977; refs  
Legislative Notes.  
Availability: See publication

## **SOME INTERNATIONAL COMPARISONS OF THE EFFECTS OF MOTOR VEHICLE SEAT BELT USE AND CHILD RESTRAINT LAWS**

Original data on seatbelt usage collected in 19 cities of five countries (Australia, Canada, Japan, New Zealand, and the U.S.) within the past three years are presented, as well as preliminary data on child restraint use before and after the recent child restraint law in Tennessee. Some tentative principles regarding the effectiveness of belt use and child restraint laws have been derived from this research. First, compliance with the laws is greater when there are fewer exemptions. In Ontario and Quebec, Canada, where shoulderbelt use in pre-1974 cars was exempted, belt use was halved within six months after the law. A subsequent enforcement campaign regained some of the reduction, but not nearly to the point of countries with laws that have few exemptions. In Australia and New Zealand, where there are few exemptions to the belt laws and retrofitting of older vehicles has subsequently been required, belt use remains relatively high. In Japan, where belt use is required only on freeways and there are no penalties for nonuse, belt use is virtually nil. In Victoria, Australia, child restraint use in front seats is not nearly as high as adult belt use after the law, perhaps partially a result of the exemption of children in rear seats. In Tennessee, with its exemption of children held in adult arms, child restraint use increased only slightly after the law, relative to use in Kentucky without a child restraint use law. Second, belt use laws do not reduce deaths and injuries as much as expected, from known effectiveness of belts when worn voluntarily. Belts are less often worn by persons disproportionately involved in severe crashes, particularly teenagers and persons driving with high blood alcohol concentrations. Also, belts are often worn too loosely to reduce severity of contact with interior surfaces in even moderate-to-low-speed crashes. The limitations in the effectiveness of belt use laws should not be taken as arguments against such laws. However, because of their limited effectiveness, belt use laws should not be considered as alternatives to improved crashworthiness of vehicles, and to environments that do not require special action by vehicle occupants when they use the vehicle.

by Leon S. Robertson; Allan F. Williams  
Insurance Inst. for Hwy. Safety, 600 New Hampshire Ave.,  
N.W., Washington, D.C. 20037  
1978; 19p 12refs  
Presented at Child Passenger Safety Conference, Nashville,  
Tenn., 10 May 1978.  
Availability: Corporate author

HS-023 471

## **EVALUATION OF THE TENNESSEE CHILD RESTRAINT LAW**

An evaluation has been made of a Tennessee law which came into effect on 1 Jan 1978, requiring parents to properly restrain their children under the age of four years in child restraint systems during travel in motor vehicles. Alternatively, the law permits children to be held in the arms of adult passengers. Before and after the law went into effect, observations were made of children in cars exiting from shopping centers in Knoxville and Nashville, Tenn. and in Lexington and Louisville, Ky., and in an adjacent state not having a child restraint law. More than 80% of the children observed in Tennessee in the fourth month the law was in force were not

using child restraints anchored by seatbelts, although usage rates increased in Tennessee (8% to 16%) to a greater extent than in Kentucky (11% to 15%). In Nashville, but not in Knoxville or in the Kentucky cities, there was a substantial increase in the number of children two and three years of age who were traveling in the arms or on the laps of adult passengers. Almost four in ten children less than four years of age were traveling in such a manner in the fourth month of the law. The reason for this increase could be related to an extensive public information and education campaign concerning the law which had begun in Nashville before the post-law observations were made. The public information campaign material does not mention travel in arms as an option under the law. However, there is the possibility that as general awareness of the law increases, travel in arms or on laps will also increase, in addition to or instead of child restraint use. This may also occur in response to police enforcement which had not yet begun at the time of the study. In any case, the hazards of children traveling in the arms or on the laps of adult passengers have been well documented, and it is important that consideration be given to removing this unfortunate exemption to the law as soon as possible. Despite the results thus far in Tennessee, seatbelt legislation based on scientific knowledge concerning crash protection remains a potentially important strategy for increasing the protection of children in cars, and should be encouraged.

by Allan F. Williams  
Insurance Inst. for Hwy. Safety, 600 New Hampshire Ave.,  
N.W., Washington, D.C. 20037  
1978; 16p 9refs  
Availability: Corporate author

HS-023 472

## **THE EFFECTS OF SEAT BELT LEGISLATION ON ROAD TRAFFIC INJURIES**

The compulsory wearing of seat belts, first introduced in the world in Vic., Australia in 1970, has effectively reduced the number of deaths and injuries by approximately one third for car occupants involved in motor vehicle crashes. Initially, the legislation did not apply to children under the age of eight years, but in 1975 a further law was introduced banning children from the front seat of any vehicle unless properly harnessed. There is a need for further research into the rearward facing of restrained children and the use of protective headgear. Seatbelt restraint gives greater protection in front impact than in side and rear impact collisions. Further research is needed relating to the belt, the seat, and the car capsule, if there is to be improved protection of car occupants involved in side impact collisions. Ten percent of car occupants admitted to hospital after a frontal impact show injuries, mostly minor, directly attributable to the wearing of seat belts. A further reduction in death and injury would occur if there were total restraint of all occupants at all times. Improvement in the wearing rate would result from improved belt design, giving maximum protection and comfort; sustained education and promotion campaigns; mandatory legislation to cover all occupants of all vehicles, and adequate enforcement of such legislation.

by G. W. Trinca; B. J. Dooley  
Publ: Australian and New Zealand Journal of Surgery v47 n2  
p150-5 (Apr 1977)  
1977; 5refs  
Availability: See publication

HS-023 473

HS-023 473

### **VALIDATION OF A PROGRAMMED INSTRUCTION TECHNIQUE FOR DRIVER EDUCATION**

Six programmed instruction booklets on driving situations and traffic rules (driving in urban areas, on the road, on motorways, passing of intersections, driving at night and in bad weather, and various information on driver and traffic safety) were produced by the French National Road Safety Organization (ONSER) and experimentally tested in several driving and secondary schools. Results show that these booklets are an effective instructional tool even for self-taught students, but learning is most effective when they are used in conjunction with a collective course using the same format for presentation. The booklets provide important learning gains for students of all sociocultural levels, but the final level of performance remains lower for pupils of lower sociocultural levels. Use of the booklets removed the initial difference in levels of knowledge between men and women; the initial level of men was superior ( $t = 0.75$ , significant at the .001 level). Although the objective of developing a validated pedagogical curriculum was attained, the transfer of this cognitive learning to actual driving has not been demonstrated. This material has been favorably received, particularly among the young. The statements of some responsible driving school personnel suggest that these booklets are also appreciated by adults working on their own in preparing for their driver's license examination.

by Maryse Simonnet; Dan Moukhwas  
Publ: Human Factors v18 n6 p587-91 (Dec 1976)  
1976; 5refs  
Availability: See publication

HS-023 474

### **SUMMARY REPORT ON PROJECT TAGS. AN EXPERIMENT IN MASS SCREENING OF LICENSE PLATES TO IDENTIFY MOTOR VEHICLE LAW VIOLATIONS**

A two-phase demonstration project called TAGS, initiated in Dec 1973 by the Maryland Motor Vehicle Administration, the Maryland State Police, and the Insurance Inst. for Hwy. Safety, to test a new approach developed by the Institute for identifying vehicles and operators involved in certain types of unlawful activity is reported. The method of identification is based on the use of rapid, computer-based mass screening of the vehicle registration plates of either parked vehicles or those in motion. Based on information already in the state's records, the screening only identifies vehicles whose plates indicate they are wanted (e.g. stolen cars and cars involved in the commission of felonies), or vehicles whose drivers, there is specific reason to believe, may be operating illegally (e.g. with suspended or revoked driver's licenses). Mass screening will actually work in a variety of urban, suburban, and rural environments. The initial phase carried out the mass screening by using a separate vehicle (a van) equipped with observers, keyboard/displays, and a minicomputer system containing a list of registration plate numbers of interest. This screening van accompanied one or two Maryland State Police patrol cars. The second phase incorporated the mass screening function directly into patrol cars equipped with specially designed query devices that contained the list of registration plate numbers. In these cars, the observer, using a console/display located just in front of the right front passenger position, per-

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forms the mass screening function. During the first quarter of 1977, the last three months of the project, the results of mass screening were compared with those of normal police operations in Baltimore County, Md. The mass screening produced an appreciably higher yield of citations for driving while licenses were suspended, revoked, cancelled, or refused, than the normal operations. This does not, however, necessarily imply that this would always be the case in other operational contexts.

by A. Eugene Miller  
Insurance Inst. for Hwy. Safety, Watergate 600, Suite 300,  
Washington, D.C. 20037  
1978; 93p 12refs  
Availability: Corporate author

HS-023 475

### **A MANUFACTURER'S LOOK AT FREIGHT VEHICLES**

The trailer industry plays an integral role in heavy over-the-road transportation. In many respects, the environmental and governmental issues facing this industry are virtually identical to those that face heavy truck manufacturers (e.g. size, weight, and length laws; economy and energy conservation and their impact on design; safe designs). The size and scope of the market are also quite similar; the same economic influences come to bear and a common customer base, in most respects, is addressed. Both trucks and trailers have followed the economic (and often government-initiated) roller coaster of demand over the past several years. Currently, both industries are enjoying an economic recovery. In addition, the competitive structure of the two industries has certain similarities. In 1977, for example, U.S. registrations of trucks and trailers by the top five manufacturers show striking similarities in relative size and competitive position. The respective industry volume leaders enjoy about 25% of the market. However, the truck manufacturers are clustered at the 13%-15% share-of-the-market level, while the trailer manufacturers are grouped at the 4%-6% level. But although the commercial trailer industry parallels the truck industry in many respects, there are facets to the former that are unique in design approach. The trailer-on-flatcar (TOFC) and container-on-flatcar (COFC) permit the trailer industry to participate in the bimodal equipment market. Piggyback has shown impressive growth in 1976 and 1977. The 11.9% increase in piggyback loadings for 1977 outstrips the 8.5% increase in truck tonnage for Class I and II carriers. Container and chassis manufacture also involves the bimodal approach to freight transportation. To date, containers and chassis have found their greatest usage in import/export movements and the overland movement of containerized international freight. Commercial trailers are the largest segment of the U.S. container manufacturing industry, and of that segment the dry freight trailer constitutes the largest share. The average number of trailers and the ratio of trailers to tractors shows that both the common/contract carriers and the lease/rental customers carry a great deal of clout in the trailer industry. The short-term outlook appears favorable for most segments of the trailer industry. Even allowing for problems from the Federal Motor Vehicle Safety Standard 121 brake standard controversy, the longer term prospects for the industry remain bright. A temporary setback is expected in 1979 resulting from an overall economic slowdown, but the industry growth is expected to resume and continue. By 1982, shipments should reach 215,000 units. New technology (e.g. use of lightweight-high strength steels, high-performance disc brakes,

improved suspension designs) will play an increasingly important role in the long-term perspective.

by William J. Linden

Publ: Traffic World v174 n12 p33-4, 36, 38 (19 Jun 1978)

978

Availability: See publication

HS-023 476

# **OTOS/MBT [N-OXYDIETHYLENETHIOCARBAMYL-N'-OXYDIETHYLENESULFENAMIDE; 2-MERCAPTOBENZOTHAZOLE] DERIVATIVE VULCANIZATION SYSTEM**

OTOS (N-Oxydiethylenethiocarbamyl-N'-Oxydiethylenesulfenamide) /MBT (2-Mercaptobenzothiazole) derivative acceleration systems were compared with benzothiazole sulfenamide acceleration systems in four practical applications (a passenger tire tread, a heavy-duty tire tread, a hot-service conveyor belt cover (low sulfur), and an off-the-road tread (low sulfur)). The accelerator equivalent ratio in the OTOS/MBT derivative systems ranged from about 1:1 to 2:1. Since proper balance is important, each application is treated as a separate comparison. The results of these comparisons suggest that many of the effects of OTOS/MBT derivative systems appear in most applications. These common effects are low acceleration cost, ample scorch safety, high sulfur utilization efficiency, and exceptional cross-link network stability.

by K. C. Moore

Publ: Elastomerics v110 n6 p36-42 (Jun 1978)

978; 10refs

Based on "Use of N-Oxydiethylenethiocarbamyl-N'-Oxydiethylenesulfenamide with Benzothiazole Derivatives in Low Cost, High Quality Vulcanization Systems," presented at meeting of Div. of Rubber Chemistry, American Chemical Society, Chicago, 3-6 May 1977.

Availability: See publication

HS-023 478

# **APPLICATION OF PERFORMANCE AND RELIABILITY CONCEPTS TO THE DESIGN OF CERAMIC REGENERATORS**

Four regenerator matrix samples, fabricated by different manufacturing methods and consisting of different ceramic materials and cell geometries, were studied to determine their reliability and performance potential in a typical industrial gas turbine engine. The performance and reliability analysis was based on Ford Motor Co.'s shuttle rig performance tests and over 200,000 core-hours of engine test on ceramic regenerators; the engine test program is described in detail. The four matrices selected for this study represent current state of the art and consisted of the following configurations: a sinusoidal fin from AS (aluminum silicate) material, a sinusoidal fin from thin-wall AS material, a rectangular fin from MAS (magnesium aluminum silicate) material, and a square fin with a large hydraulic diameter from MAS material. Hypothetical regenerators from all four matrices were sized to give identical performance. Regenerators sized from the first three matrices had essentially the same outside diameter; the sinusoidal fin from thin-wall AS material was the most compact, having a 54.5 mm (2.15 inch) axial width; the rectangular fin from MAS material was the largest, having a 76.2 mm (3.00 inch) width. The matrix with the large hydraulic diameter resulted in the smallest

frontal area but had a 256 mm (10.1 inch) length. Stress analysis for 800 degrees C (1472 degrees F) operation of these hypothetical regenerators showed that the thermal stress safety factors of both sinusoidal fins were satisfactory. The square fin would require a stress-relieved rim and the rectangular fin would require both a preloaded and stress-relieved rim to achieve an adequate rim safety factor. The latter two configurations would be expected to have a lower cost and be easier to drive and mount than the former two configurations. They would also be expected to have greater leakage.

by J. A. Cook; C. A. Fucinari; C. J. Rahnke  
Ford Motor Co.

Rept. No. SAE-770334; 1977; 19p 9refs

Presented at International Automotive Engineering Congress and Exposition, Detroit, 28 Feb-4 Mar 1977.

Availability: SAE

HS-023 479

# **FABRICATING OF DENSE SILICON NITRIDE PARTS BY HOT ISOSTATIC PRESSING**

A new process to fabricate dense silicon nitride parts utilizes true hot isostatic pressing (HIP), and the results achieved so far indicate that most of the advantages of both the reaction bonding (RB) and the hot pressing in graphite dies (HP) processes are obtained without any of their major drawbacks (e.g. high porosity in RB silicon nitride, and limited shapes of HP silicon nitride). In the HIP process, the silicon nitride powder is preformed to the final shape with compensation for the shrinkage occurring when compacted to full density. The green body is encapsulated and then compacted in an ASEA QUINTUS press equipped with a special high-temperature furnace. During the press cycle the body shrinks uniformly to the final shape. As the shrinkage can be controlled and as no reaction zone occurs, components can be manufactured without any machining afterwards except for surfaces with very close tolerances. The high pressure available, one magnitude higher than in ordinary hot pressing, and the uniform way of applying it results in a fully isotropic material. This makes it possible to compact silicon nitride powder with very low impurity levels to full density without addition of sintering aids, or with very little. High rupture strength in three-point bending and very low creep at high temperature have been achieved. Furthermore, the Weibull m-module values are consistently high. Up to now parts composed of cylindrical, conical, and flat sections have been fabricated to final shape without any machining of the densified material. The adaptation of the ASEA HIP process to parts as complicated as monolithic turbine wheels is underway and is believed to be feasible even for large-scale production.

by Hans Larker; Jan Adlerborn; Hans Bohman  
ASEA, Sweden

Rept. No. SAE-770335; 1977; 10p 5refs

Presented at International Automotive Engineering Congress and Exposition, Detroit, 28 Feb-4 Mar 1977.

Availability: SAE

HS-023 480

# **ARMY'S EXPERIENCE ON ONE AND ONE QUARTER TON COMMERCIAL TRUCKS**

The M880 Series one and one quarter ton commercial truck system is the Army's first large-scale project to selectively

replace existing militarily-designed tactical vehicles with commercial vehicles. This program was initiated under the guidance of the Army's Wheels Study (1971) which was a comprehensive analysis of the Army's management and utilization of wheeled vehicles and related equipment. To date, over 15,000 commercial one and one quarter ton vehicles have been fielded worldwide to active army and foreign military sales customers, with an additional 28,000 vehicles to be fielded during the remainder of 1977. The M880's are well accepted by their users.

by Fred Hissong, Jr.  
Army Tank-Automotive Material Readiness Command  
Rept. No. SAE-770338; 1977; 6p  
Presented at International Automotive Engineering Congress and Exposition, Detroit, 28 Feb-4 Mar 1977.  
Availability: SAE

HS-023 481

### **THE NEW X1100 AUTOMATIC TRANSMISSIONS FOR THE XM1 TANK**

The X1100 is a fully automatic shifting transmission which has been designed and developed for vehicles in the 49 to 60 ton class, operating at speeds of 40 to 50 mph; it has achieved all of the requirements for use in the Army's vehicles of the 1980's and 1990's (higher vehicle speeds, improved mobility, higher power-to-weight ratios, compatibility with gas turbine and diesel engines, improved steering and braking). Laboratory and vehicle testing has shown that the X1100 has met or exceeded performance and durability goals for this point in its product life cycle. A modular design is utilized to provide application flexibility for diesel or turbine engines of 1300 to 1500 gross horsepower capacity, as well as adaptation to the current M60 tank. This automatic transmission features a hydrostatic steer system with pivot steer, a four-speed range pack, integral power brakes, and a high-speed reverse. The torque converter can be locked up in all gear ranges to provide optimum transmission performance.

by J. W. Schmidt; G. L. Hadley  
Detroit Diesel Allison  
Rept. No. SAE-770339; 1977; 12p  
Presented at International Automotive Engineering Congress and Exposition, Detroit, 28 Feb-4 Mar 1977.  
Availability: SAE

HS-023 482

### **LANDING VEHICLE ASSAULT (LVA) [ADVANCED AMPHIBIAN VEHICLE; MARINE CORPS]**

A new amphibian vehicle, Landing Vehicle Assault (LVA), is under development to replace the current Marine Corps LVTP-7 (Landing Vehicle Tracked Personnel, Model 7) in the late 1980's. Contracts with Bell Aerospace, FMC Corp., and Pacific Car and Foundry Co. have provided conceptual designs. These include planning/track and air cushion vehicle (ACV)/track hybrids. LVA will carry 25 to 34 troops at high speeds over water (25 to 40 mph) and overland (40 to 55 mph). Included in the development is a 1500 hp stratified-charge rotary combustion engine. Other hardware developments include experimental fullscale planning and ACV hydrodynamic vehicles and a lightweight aluminum track. The major risks confronting LVA are related to engines, over-water ride quality, and complexity. It is not known whether the vehicle, when

operating at high speeds over water, can deliver its troops ashore in combat-ready condition. As for the engine, which has to meet both over-land and over-water conditions, there will probably be two 1500 hp rotary engines in each vehicle.

by Edwin B. O'Neill  
David W. Taylor Naval Ship Res. and Devel. Center  
Rept. No. SAE-770340; 1977; 7p  
Presented at International Automotive Engineering Congress and Exposition, Detroit, 28 Feb-4 Mar 1977.  
Availability: SAE

HS-023 483

### **THE PROSPECTS OF LIQUID COOLING FOR TURBINES**

A careful review of the history of turbine liquid cooling is presented, starting from the cooling studies of Schmidt in the early 1940's to the present; an assessment of possible application advantages and disadvantages is provided. Liquid cooled turbines are not in production today. Any liquid turbine must have the following three principal advantages in order to compete against a highly refined, existing, air cooling technology: one or more significant gas dynamic performance advantages, devices of improved simplicity, and reduced product cost. It has been argued that the principal shortcoming in the past liquid cooling design attempts has been the minor consideration given to improved simplicity. To provide a background example, a 180 shp (shaft horsepower) SGT (small gas turbine) cycle is considered. It is shown that substantial improvements in SFC (specific fuel consumption) can be won by increasing turbine inlet temperature, at least to a reasonable extent. A very simple rotor design is shown for this application and three methods of cooling are considered. The design problem is restrained by high-volume, low-cost production requirements. Substantial performance advantages can be demonstrated for liquid cooling as opposed to conventional air convection cooling. The design example is offered to stimulate further consideration of liquid cooling, particularly in the SGT area. The prospects for employing liquid cooling in future turbine designs are good, but competition from alternative approaches (e.g. ceramics) is strong.

by David Japikse  
Creare Inc.  
Rept. No. SAE-770341; 1977; 16p 23refs  
Presented at International Automotive Engineering Congress and Exposition, Detroit, 28 Feb-4 Mar 1977.  
Availability: SAE

HS-023 484

### **APPLICATION OF CERAMICS TO A RADIAL INFLOW GAS TURBINE**

A development program to increase erosion resistance, extend life, reduce component cost, and increase power-to-weight ratio through the use of a ceramic turbine nozzle section in gas turbine engines is described. Results of engine simulator tests of an all-ceramic nozzle constructed with special relaxing high-temperature adhesives are presented. The erosion and corrosion properties of hot pressed silicon nitride (HPSi3N4) have been shown to be one to two orders of magnitude better than superalloys in a simulated engine operating environment. In addition, thermal shock experiments which simulate a more severe than normal engine operating sequence show that

HPSi3N4 can survive a small radial gas turbine engine thermal life cycle as nozzle vane sections. Engine tests of a ceramic vane section nozzle, including 50 start/stop cycles, verified that thermal shock was not a problem. However, the importance of avoiding contact stresses, even in high-strength ceramics, such as HPSi3N4, became apparent from engine tests which produced a 33% failure rate due to a superalloy distortion which caused compressive stresses on ceramic vane trailing edges. Engine simulator tests of an all-Si3N4 ceramic nozzle ring demonstrated the potential for use of an all-ceramic nozzle in a small radial gas turbine. The importance of proper fastening techniques of ceramics was made apparent by test results where short-circuiting of an insulation layer resulted in crack formation in the ceramic shroud. Ceramics appear to be feasible for application to small radial turbine nozzles, but development to the point where they can become practical depends heavily upon proper design techniques, particularly as they relate to the inevitable transitions at joints between ceramic and metal alloy components.

by F. D. Jordan; J. C. Napier; A. G. Metcalfe; T. E. Duffy  
Army Mobile Equipment Res. and Devel. Command, Electrical Power Lab.; International Harvester, Solar Div.  
Rept. No. SAE-770342; 1977; 16p 7refs  
Presented at International Automotive Engineering Congress and Exposition, Detroit, 28 Feb-4 Mar 1977.  
Availability: SAE

HS-023 485

#### **SUMMARY OF NASA [NATIONAL AERONAUTICS AND SPACE ADMINISTRATION] RESEARCH ON THERMAL-BARRIER COATINGS**

A durable, two-layer, plasma-sprayed coating consisting of a ceramic layer over a metallic layer (yttria-stabilized zirconia ceramic, 0.028 to 0.064 cm thick, over a NiCrAlY (nickel-chromium-aluminum-yttrium) bond coating about 0.010 cm thick) was developed that has the potential of insulating hot engine parts and, thereby, reducing metal temperatures and coolant flow requirements and/or permitting use of less costly and complex cooling configurations and materials. The investigations evaluated the reflective and insulative capability, microstructure, and durability of several coating materials on flat metal specimens, a combustor liner, and turbine vanes and blades. In addition, the effect on the aerodynamic performance of a coated turbine vane was measured. The tests were conducted in furnaces, cascades, hot-gas rigs, an engine combustor and a research turbojet engine. Measured turbine-vane metal temperatures in a research turbojet engine indicated metal temperature reductions of 190 degrees K by using the coating. Analytically, the coolant flow requirement for a convection-cooled turbine with a thermal-barrier coating was similar to that required for a more complex full-coverage, film-cooled turbine without a coating. Using the coating on the liner of an engine combustor gave significant reductions in metal temperatures and flame radiation and small reductions in exhaust-gas smoke concentration. The coatings completed significant test times and cycles in hot-gas environments without spalling. No deterioration was noted in engine testing, and only erosion of the coating was observed in severe test conditions in a hot-gas rig. The NiCrAlY bond coating adhered well to the blade wall surfaces. Cracks were not found in the yttria-stabilized or magnesia-stabilized zirconia but were detected in the calcia-stabilized zirconia coating. The yttria-stabilized zir-

conia also showed less erosion of the surface than did the magnesia-stabilized zirconia.

by Francis S. Stepka; Curt H. Liebert; Stephan Stecura  
National Aeronautics and Space Administration, Lewis Res. Center  
Rept. No. SAE-770343; 1977; 16p 9refs  
Presented at International Automotive Engineering Congress and Exposition, Detroit, 28 Feb-4 Mar 1977.  
Availability: SAE

HS-023 519

#### **DOES QUALITY DRIVER EDUCATION PRODUCE SAFER DRIVERS?**

The DeKalb County (Georgia) School System/NHTSA (National Hwy. Traffic Safety Administration) Driver Education Evaluation Project was initiated in Sep 1976 to carry out the development, implementation, and evaluation of a previously developed Safe Performance Curriculum (SPC), driver education curriculum based on a sophisticated driving task analysis. The short-term objectives of the project are to evaluate the SPC driver education course, and the long-term goals are to provide quality driver education and traffic-related services for all DeKalb County residents. The facilities for implementation of the course include three 30-car driver education ranges and one 15-car range, and 30-car simulation systems in three of the driver education centers and a 5-car simulation system in one center. The 30-car ranges were designed not only to be more cost-effective in terms of staff use, but also to enable the beginning driver to gain driving experience in an environment closely resembling real-world driving conditions. The motivation for the 30-car simulation installations was economic. Other cost-effective measures included in the program are a double-period driver education class that reduces student transportation time and cost by 50%, employment of teacher aides to perform such tasks as servicing driver education vehicles; and provision of multiple-phase instructional capabilities at each center. Most of the driver education teachers hold advanced degrees in driver and traffic safety education. Prior to program implementation, all teachers participated in a 320 clock-hour training program designed to prepare them to teach the SPC using the school system's sophisticated instructional system. All teachers continue to expand and improve their teaching capabilities through an ongoing, school-system sponsored, in-service educational program. The evaluation portion of the project is being carried out by the Battelle Inst. (Columbus, Ohio) and is based on a three-group comparison design (two treatment groups (SPC students and a PDL (pre-driver-licensing) group who receive a basic driver training course designed to prepare the beginning driver to pass the Georgia Motor Vehicle Operator's Test, and a control group).

by Jack K. Weaver  
Publ: Traffic Safety v78 n6 p18-20, 30 (Jun 1978)  
1978  
Availability: See publication

HS-023 520

#### **AUTO ANTI-THEFT DEVICES**

The following types of antitheft devices are described: hood lock/ignition cutoff, "cane" type steering wheel locks, ignition collars, fuel cutoffs, chain and cable devices, and miscellane-



ous theft deterrents (e.g. the Identicar Vehicle Theft Deterrent System, a sort of branding system for autos). (Alarm systems for autos are often ineffective because the chance of someone's hearing the noise and being ready to incur the risks of taking effective action would in many locations be fairly slim; therefore, they were not included in the present study.) Various models of antitheft devices are ranked A, B (Intermediate), or C (Not Recommended); information provided for each includes manufacturer and address, price, where sold, description, and warranty. One should, before buying any of these devices, ask to see the instructions and the warranty. Those models classified "A" include the Auto Sentry, Model L 1000 C; Chapman Insurance Man Kar Lok, Model KL2007; Fuel-Loc, Model K-200; Hood and Ignition Lock, Model 1007 BC (Standard); and Petrolock, Model MPC.

Publ: Consumers' Research Magazine v61 n7 p14-8 (Jul 1978)  
1978

Availability: See publication

## HS-023 521

### RELATIONSHIP BETWEEN THE REMOVAL OF TRAFFIC SIGNALS AND INTERSECTION ACCIDENTS

An examination of the before and after accident history at five intersections in Terre Haute, Ind. where traffic signals were replaced with stop signs is presented. All five intersections studied are located in predominantly residential areas with some small retail business. Pedestrian traffic is light. The intersections are undivided with four approaches and are located at least two blocks from the nearest control device or railroad crossing. The signal design at each of the intersections consisted of a single, four-faced signal with three 8-inch lenses in each face, suspended over the center of the intersection between two telephone poles. After removal of the signals, four-way stop control was installed at three of the intersections; the other two were converted to two-way stop control. Those accidents that occurred at or near the intersection because of a driver's or pedestrian's failure to obey the traffic control device, or that occurred because of the presence of the control device at the intersection (e.g. rear-end accident in queue behind stop line), were included in the before and after comparison. From the results of the study, it cannot be concluded that there will be a significant decrease in accidents at low-volume, signalized intersections if the signal is removed. It can be said, however, and this is extremely important, that there will not be a significant increase in the number of accidents as the general public believes. The traffic signal is nothing more than a regulatory valve. When used properly, it can reduce accidents; but it should be removed from those intersections where it is not warranted. The result will be a decrease in delay, a greater respect by motorists for other warranted traffic signals, and very likely a decrease in accidents.

by Louis G. Neudorff

Publ: Transportation Engineering v48 n3 p16-20 (Mar 1978)  
1978; 15refs

Availability: See publication

## HS-023 522

### BENEFITS OF HIGHWAY SAFETY IMPROVEMENTS IN CALIFORNIA

The California fatality rate (persons killed per 100 million vehicle miles of travel (VMT) on the California State Hwy. System declined 48% in the ten-year period from 1966 to 1976. This system served 77 billion VMT in 1976 during which 1768 persons were killed in traffic crashes. As bad as this toll is, it must be considered that if there were 77 billion VMT at the 1966 fatality rate, an additional 1690 persons would have died. Two things of major importance to highway safety occurred in the mid 1960's, both of which had an impact on the fatality rate. The first was the safe roadside concept, the idea that roadsides should have a forgiving quality for vehicles which run off the traveled way. This means flat slopes with no sharp ditches or rigid fixed objects. The second major event was the Highway Safety Act of 1966. One important result of that legislation is the requirement that each state have a systematic procedure for identifying high hazard locations and roadside obstacles and implement a program of corrective action. In 1966, California undertook to incorporate the safe roadside concept in new freeway design, and to the extent possible, in existing freeways, by a retrofit program called CURE (Clean Up Roadside Environment). Between 1966 and 1973 the overall reduction in the fatality rate was primarily due to fewer off-the-road accidents. The freeway fatality rate dropped 39% in 1974 with the imposition of the 55 mph speed limit; this compares with a decline of 30% in the prior seven years. Other programs include clearing or protecting with crash cushions fixed objects in freeway gores (fatalities from vehicles hitting such objects decreasing from 19 in 1966 to 8 in 1973 to 6 in 1976); cutting grooves in concrete pavements or resurfacing asphalt pavements to reduce wet weather skidding accidents (annual reduction of over 1800 accidents, including 30 fatalities); and reducing wrong-way driving by improved signing and experimental installation of devices at freeway off-ramps. The primary safety effort on conventional state highways is the spot improvement program (any kind of highway improvement which is in response to the accident history at the point in question).

by David H. Henry

Publ: Transportation Engineering v48 n3 p21-4 (Mar 1978)  
1978

Availability: See publication

## HS-023 523

### HUMAN FACTORS AND THE HANDICAPPED

An overview of some of the problems of handicapped people and the challenge they represent to human factors specialists and engineering psychologists is presented. Focus is placed on several types of handicapping conditions (impaired vision and hearing, paralysis, missing and malfunctioning limbs, and mental retardation) and their implications for several aspects of normal life (mobility and transportation, manipulation and control, communication, employment, and independent living). The licensing of drivers with various types of handicaps is considered. State policy about licensing the handicapped is not currently uniform. The goal in establishing licensing criteria should be to place on the handicapped the same demands vis-a-vis driving safety that are placed on the nonhandicapped driving population. It is clear that there are many needs and that what has been accomplished to date, while having reduced the limiting effects of some handicaps to some extent,



represents only a beginning relative to what remains to be done. The report of the National Res. Council's Com. on National Needs for the Rehabilitation of the Physically Handicapped recognizes the importance of a multidisciplinary approach to the problem of applying technology to the alleviation of handicapping conditions. Only a very small fraction of the country's scientific and technological capabilities have been applied to problems of the handicapped; few of the devices used by handicapped persons show the influence of current technology. Many of the unanswered questions and unmet needs represent challenges and opportunities for designers of tools and environments for human use or habitation; engineering psychology has much to offer to this problem area.

by Raymond S. Nickerson

Publ: Human Factors v20 n3 p259-72 (Jun 1978)

1978; 13refs

Availability: See publication

HS-023 524

### BICYCLE-SAFE GRATE INLETS

The three phases of the research on 11 grate designs for bicycle and pedestrian safety, structural integrity, and hydraulic efficiency were an examination of manufacturing methods and structural analysis, bicycle-pedestrian safety tests, and hydraulic testing. It was found that for flat longitudinal street slopes, the hydraulic efficiency of grates of a given width and length varied less than 6%; however, when longitudinal street slope was steep, the variation in some instances was as high as 34%. Possibly, roughening the tops of bars of a grate would reduce the hazard of bicycle tire slippage while turning a corner. In general, the grate designs which are rated high in bicycle safety are rated low in debris-handling characteristics. The following three grate designs were found to be superior in safety characteristics and had better overall hydraulic performances: the curved vane grate; the parallel bar grate with 1-1/8 in (29 mm) spacings and transverse spacers; and the parallel bar grate with 1-7/8 in (48 mm) spacings and transverse rods spaced at 4 in (102 mm). These grates were also found to be practical to fabricate or cast. For mild longitudinal street slopes, other grate designs also perform well hydraulically. As the more efficient grate designs do not necessarily have better debris-passing characteristics, the designer can choose the grate design which best suits the given conditions.

by Dah-Cheng Woo

Publ: Public Roads v42 n1 p1-5 (Jun 1978)

1978; 8refs

Availability: See publication

HS-023 525

### EFFECTS OF VISUAL AND AUDITORY IMPAIRMENT IN DRIVING PERFORMANCE

A review of surveys, analyses, and experimental studies was conducted to determine driver education and training needs, driver licensing requirements, and actual driving performance of individuals with vision and hearing deficits. While research seems to indicate that vision deficiencies have an adverse effect on safe driving performance, a number of severely visually impaired individuals have been shown to drive safely with the aid of telescopic lens spectacles. Research results to date are not adequate to establish the auditory requirements for safe driving performance, but there is little evidence to

suggest that hearing-impaired individuals, with the possible exceptions of totally deaf males and older deaf drivers, do not drive as safely as the general population. A great deal of research is needed in the area, particularly in the establishment of requirements for driver education and training programs for both vision-limited and hearing-limited individuals. The direction in the future for driver education and licensing of all handicapped persons should be for improved diagnostics and treatment of critical safe driving performance skills. Diagnostic testing, for example, should be conducted with the view of informing the individual and the driver trainer where the weaknesses lie with respect to those critical skills. Driver training may then be performed more specifically toward enhancing or compensating for those skills. In general, a more favorable attitude seems to be growing toward removing barriers to transportation for the handicapped and elderly. The rewards both to society and the individual seem too great to overlook driving as a very desirable means for eliminating many of those barriers.

by Harold R. Booher

Publ: Human Factors v20 n3 p307-19 (Jun 1978)

1978; 30refs

Availability: See publication

HS-023 526

### DEVELOPMENT OF TECHNIQUES AND DATA FOR EVALUATING RIDE QUALITY. VOL. 1: SUMMARY. FINAL REPORT

by R. D. Pepler; L. L. Vallerie; I. D. Jacobson; R. W. Barber; L. G. Richards

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DOT-TSC-1090

Rept. No. DOT-TSC-RSPD-77-1-Vol-1; 1978; 17p 1ref

Rept. for Jun 1975-Mar 1977. For abstracts, see HS-023 527 and HS-023 528.

Availability: NTIS

HS-023 527

### DEVELOPMENT OF TECHNIQUES AND DATA FOR EVALUATING RIDE QUALITY. VOL. 2: RIDE-QUALITY RESEARCH. FINAL REPORT

A research program to develop quantitative models of the subjective reaction to the ride environment of city buses and intercity trains is reported. The ride-quality models developed using field data obtained from both paid subjects and regular passengers, the methods and procedures employed to derive the models, and examples of how models are used to evaluate the ride quality of existing and future transportation systems are discussed. Passengers are clearly influenced by the dominant input mode on each type of vehicle; comfort judgments correlate most strongly with those factors that vary most. For ground-based vehicles, roll rate was the dominant motion and passenger comfort judgments were strongly related to it. In the air mode, the linear accelerations, vertical and transverse, were most important. But the correlation matrices and their principal components indicate that there are similarities in the motion characteristics of these vehicles, and suggest that unified comfort models are feasible, given more extensive data. Such general models are needed to specify standards for exposure to environmental inputs and to specify criteria for

the design of new vehicles or the assessment of existing ones. Passenger comfort is, of course, determined by other factors in addition to motion and noise. Aircraft data clearly show the influence of seat characteristics: good seat design can compensate for a basically poor motion spectrum; conversely, poor seats can lower passenger comfort in good motion environments. A complete comfort model would involve both motion and seat variables, as well as other physical factors such as pressure and temperature. Some systematic variance in comfort judgments was due to individual differences between passengers; such differences were expected and the passenger characteristics used here did prove to be important. The raw data used as a basis for the models are appended.

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DOT-TSC-1090  
Rept. No. DOT-TSC-RSPD-77-1-Vol-2; 1978; 162p 22refs  
Rept. for Jun 1975-Mar 1977. Summary rept. is HS-023 526, Vol. 3 is HS-023 528.  
Availability: NTIS

HS-023 528

**DEVELOPMENT OF TECHNIQUES AND DATA FOR EVALUATING RIDE QUALITY. VOL. 3: GUIDELINES FOR DEVELOPMENT OF RIDE-QUALITY MODELS AND THEIR APPLICATIONS. FINAL REPORT**

Procedural guidelines to be employed by transportation specialists in developing ride-quality models and in using them to evaluate passenger comfort in existing or future systems are presented. Specific guidelines are provided for the following areas: collecting vehicle-motion and passenger-comfort data in the field, generating ride-quality models based on these data, validating models against data from passengers on scheduled services, using models to evaluate or predict vehicle ride quality, and specifying ride characteristics for new vehicles. Data used in the development of the models were gathered on city buses and intercity trains.

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DOT-TSC-1090  
Rept. No. DOT-TSC-RSPD-77-1-Vol-3; 1978; 48p 3refs  
Rept. for Jun 1975-Mar 1977. Summary rept. is HS-023 526, Vol. 2 is HS-023 527. Subcontracted to the Univ. of Virginia.  
Availability: NTIS

HS-023 529

**PARATRANSIT VEHICLE TEST AND EVALUATION. VOL. 1. RIDE COMFORT AND QUALITY TESTS. FINAL REPORT**

As one of five separate test series to evaluate two prototype paratransit vehicles (PTV's), procedures and results of ride comfort and quality tests are presented. The tests measured the ride characteristics of the two prototype PTV's and a baseline car (Chevrolet Nova) as they were driven at controlled speeds over a specially constructed ride course. The

vibratory inputs to the driver and passengers were evaluated against the criteria in International Standard ISO 2631 for driver fatigue and passenger comfort. None of the vehicles exceeded the fatigue decreased proficiency boundary for the driver during any of the tests. All of the vehicles, however, exceeded the reduced comfort boundary for the passengers during some of the tests. The Dutcher Industries' prototype had the best performance of all three vehicles with respect to the passenger comfort limit, exceeding the limit by only a small amount during 10-mph ride tests in the lightly loaded condition (one passenger). The Nova baseline vehicle exceeded the limit significantly during the tests in both the lightly and heavily loaded conditions (the latter, three passengers). The ASL Engineering prototype also exceeded the limit significantly during 5-mph and 10-mph tests in the heavily loaded condition, but only with the rear seat occupant. The Nova driver had the lowest overall vibration level during all of the ride quality tests, followed by the ASL and the Dutcher in all tests but one. The Dutcher generally showed the lowest vibration levels for the passengers in the lightly loaded condition, followed by the ASL and Nova. The ASL wheelchair passenger showed high vibration levels during the 10-mph test in which the vehicle bottomed. As with the driver in this same test, some high frequency vibrations were present. However, the acceleration levels in the critical four to eight Hz range were also very close to the comfort boundary limit and this contributed significantly to the higher overall weighted acceleration.

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DOT-TSC-1241  
Rept. No. UMTA-MA-06-0052-78-1; DOT-TSC-UMTA-77-49-1; 1978; 216p 1ref  
Rept. for Nov 1976-Aug 1977. Vols. 2-4 are HS-023 530--HS-023 532; vol. 5 is HS-023 538.  
Availability: NTIS

HS-023 530

**PARATRANSIT VEHICLE TEST AND EVALUATION. VOL. 2. ACCELERATION AND INTERIOR MEASUREMENT TESTS. FINAL REPORT**

As one of five separate test series to evaluate two prototype paratransit vehicles (PTV's), procedures and results of acceleration and interior measurement tests are presented. The tests determined the acceleration characteristics of the two prototype PTV's, the effects of vehicle acceleration/deceleration on vehicle passengers, the effectiveness of wheelchair restraint systems, and the available interior space for the driver and passengers. Performance data of the PTV's were compared with those of the two baseline test vehicles (Chevrolet Nova and Checker Taxicab). The Nova exhibited the best acceleration characteristics during all test conditions, followed by the Dutcher Industries' prototype. The ASL Engineering PTV had the lowest acceleration of the three vehicles under every condition. The larger engine of the Nova undoubtedly accounted for its better acceleration characteristics as compared to the PTV's with their smaller engines. The ASL had a marked delay in acceleration rates at one-quarter throttle. Peak dummy accelerations in both the Nova and Dutcher prototype were nearly identical during 650-pound load tests under three throttle conditions (greater, half, and full), ranging from 0.23 to 0.25 G; for the ASL dummy, they ranged from 0.14 to 0.2 G. A female dummy passenger was dislodged at a lower deceleration than a male dummy passenger in both

PTV's, while the opposite was true for the taxicab. The taxi had the best passenger deceleration performance for the female dummy. The best performance for the male dummy was attained by the ASL PTV. The taxi had the best overall performance when considering both dummies together. Head and thorax displacements during 0.2 and 0.4 G wheelchair longitudinal deceleration tests were small in both PTV's; the 0.6 G tests produced some significant head motions in the unrestrained condition for the ASL and the wheelchair restrained condition for the Dutcher, but head rotation was negligible. Dummy displacements were significantly greater for most of the lateral acceleration tests above 2.0 G than for the longitudinal deceleration tests; this reflects the lack of lateral support for the wheelchair occupants. The reduced shoulder and hip room in the front seat of the PTV's as compared to the taxicab is the result of enclosing the driver. The taxi possessed considerably more luggage capacity than the PTV's. Passenger ingress/egress from the PTV's should be considerably easier than for the taxicab because of the greater height of their door openings.

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DOT-TSC-1241  
Rept. No. UMTA-MA-06-0052-78-2; DOT-TSC-UMTA-77-49-2; 1978; 189p  
Rept. for Nov 1976-Aug 1977. Vol. 1 is HS-023 529; vols. 3-4 are HS-023 531--HS-023 532; vol. 5 is HS-023 558.  
Availability: NTIS

HS-023 531

### **PARATRANSIT VEHICLE TEST AND EVALUATION. VOL. 3. HANDLING TESTS. FINAL REPORT**

As one of five separate test series to evaluate two prototype paratransit vehicles (PTV's), procedures and results of handling tests are presented. The tests determined the steering and handling characteristics of the two prototype PTV's and a baseline vehicle (Chevrolet Nova). The tests assessed each vehicle's understeer/oversteer characteristics during cornering, ability to return to a straight line from a turn, capability of safely maintaining lateral accelerations, ability to be maneuvered near its lateral traction limits, and stability and controllability during rapid control reversals. All three vehicles were within the specification limits for steering gains during steady-state yaw tests. For transient yaw tests, all of the vehicles were generally within the specification limits for steering gains until the time at which the steering ratio overshoot should cease and the vehicle approaches the steady-state yaw condition (1.6 sec). All of the vehicles were close to or within the specification as they entered the steady-state condition at the 25-mph speed. However, all of the vehicles oscillated in and out of the steady-state range at 50-mph speeds. This oscillation was greatest for the ASL Engineering PTV, followed by the Nova. The Dutcher Industries' prototype was nearly within the specification for return to steady-state conditions. No noticeable overshoot occurred with any of the vehicles at 25 mph. Both PTV's met the specification for returnability performance in terms of yaw rate, with no significant differences in their performance. Their performance was considerably better than that of the Nova. With respect to returnability in terms of heading, the ASL had the best performance according to Ford ESV (Experimental Safety Vehicle) criteria. All three vehicles passed the PTV specifications for wet and dry conditions during maximum lateral acceleration tests, with one exception. Neither the Nova nor ASL met specification during

counterclockwise tests on dry pavement with a 650-pound load. All vehicles passed the breakaway control specification easily. The Nova negotiated the slalom course above the 45-mph specification during both light and heavy load tests; the ASL exceeded 45 mph with the light load but was approximately 0.5 mph under the specification with the heavy load. The Dutcher prototype was well under the specification at the heavy load condition, negotiation of course at 42 mph.

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Availability: NTIS

HS-023 532

### **PARATRANSIT VEHICLE TEST AND EVALUATION. VOL. 4. FUEL ECONOMY TESTS. FINAL REPORT**

As one of five separate test series to evaluate two prototype paratransit vehicles (PTV's), procedures and results of fuel economy tests are presented. The tests were conducted on the two prototype PTV's and a baseline test vehicle (Chevrolet Nova), as they were driven through simulated urban and suburban driving cycles. The relationships between fuel consumption and vehicle speeds were determined and maximum fuel economies were established. The Dutcher Industries' PTV had the lowest fuel economy of the three vehicles under all but one of the test conditions. It did have a higher fuel economy than the ASL Engineering PTV during the urban cycle, although it still ranked below the baseline vehicle. The fuel economy of the ASL was below that of the Nova during the urban cycle and at constant speeds of 30 mph or less. However, its fuel economy exceeded that of the Nova during the suburban cycle and at higher constant speeds, although its maximum fuel economy was still below that of the Nova. The maximum fuel economy of the baseline vehicle, although higher than that of both prototypes, occurs at a considerably lower speed than do those of the PTV's. The rate of decrease in fuel economy at higher speeds is less for the ASL than for the other two vehicles. x

by L. Wesson; C. Culley; R. L. Anderson  
Dynamic Science, Inc., 1850 W. Pinnacle Peak Rd., Phoenix, Ariz. 85047  
DOT-TSC-1241  
Rept. No. UMTA-MA-06-0052-78-4; DOT-TSC-UMTA-77-49-4; 1978; 51p  
Rept. for Nov 1976-Jul 1977. Vols. 1-3 are HS-023 529--HS-023 531; vol. 5 is HS-023 558.  
Availability: NTIS

HS-023 533

### **TOFANY URGES EMPHASIS ON "PEOPLE RELATED" FACTORS IN ACCIDENTS [PRESIDENT OF THE NATIONAL SAFETY COUNCIL DISCUSSING TRAFFIC ACCIDENTS]**

Testimony of the President of the National Safety Council on the Highway Safety Act of 1978, presented before the Consumer Subcommittee, Committee on Commerce, Science and Transportation of the U.S. Senate, is provided. The National

Highway Safety Needs Study mandated by Congress in 1975, special studies conducted by the National Hwy. Traffic Safety Administration (NHTSA), and studies by various private sector organizations have shown that human error or improper driving is a factor in approximately 85% of all traffic accidents. Therefore, priorities should be directed toward programs designed to improve driver behavior. However, since the enactment of the Highway Safety Act of 1966, only 58% of the appropriations for highway safety programs have been devoted to Section 402, only half of which are driver-related programs. On the other hand, in recent years, especially since 1974, the amount of funds invested in Section 402 programs has increased at a far greater rate than have the total appropriations for highway safety programs. The National Safety Council recommends that the Senate Com. on Commerce, Science and Transportation, and the Administration adopt a five-year program of national priorities that emphasizes the human factors associated with traffic accidents. The purpose of the program would be to provide a basis for Federal programming that is directed at preponderant causes of accidents, and to guide the Dept. of Transportation's (DOT) process of annual approvals of state programs under the proposed section 406. This program must be primarily concerned with the following areas: programs related to known high-risk, people-related accident syndromes (e.g. driving under the influence of alcohol, youth involvement in motor vehicle accidents, and accidents involving pedestrians); and programs related to proved payoff techniques for all people-related accidents (e.g. support of the 55 mph speed limit, increased safetybelt use, early voluntary use of passive restraints, and improved driver performance).

by Vincent L. Tofany  
 Publ: Traffic Safety v78 n6 p10-2 (Jun 1978)  
 1978  
 Availability: See publication

HS-023 534

### **THE RELATIONSHIP BETWEEN VISIBILITY AND TRAFFIC ACCIDENTS**

Field tests were conducted to develop statistical relationships between visibility, as defined by a visibility metric relying on luminances, and nighttime traffic accident experience on urban arterial streets, in order to provide a methodology for designing cost-effective lighting systems for urban streets. In meeting this objective, regression equations were developed and an attempt was made to analyze the effectiveness of the visibility variables separately, and in combinations. The variables included visibility (mean horizontal illumination, fifteenth-percentile luminance, mean pavement luminance, mean visibility index (VI), fifteenth-percentile VI, mean dynamic visibility index (DVI), fifteenth-percentile DVI, and weighted numerical average of the dynamic and ambient visibility levels), demographic and socioeconomic information (area designations based on categorization of sites (central business district (CBD), outlying business district (OBD), and residential fringe (RF)), population densities obtained from census tract information, and census characteristics), and nighttime accident histories (total number of dry weather accidents, total number of vehicles involved, number of property damage accidents, and composite severity (accidents weighted by severity)). Results show that as the visibility level increases, the accident rate decreases. Accidents, however, are directly related to both area type and population density. Higher population densities are associated with higher accident rates, and CBD areas

have higher accident rates than other areas. In addition, higher illumination levels are related to higher accident frequency. (A discussion follows the main text.)

by M. S. Janoff; B. Koth; W. McCunney; M. J. Berkovitz; M. Freedman  
 Publ: Journal of IES v7 n2 p95-104 (Jan 1978)  
 1978; 8refs  
 Presented at Annual IES Conference, New York, 28 Aug-2 Sep 1977. Research sponsored by Federal Hwy. Administration.  
 Availability: See publication

HS-023 535

### **THE EMT - A NEW ALLIED HEALTH PROFESSIONAL [EMERGENCY MEDICAL TECHNICIAN TRAINING COURSES]**

The various Dept. of Transportation (DOT) training courses for persons involved in emergency medical services (EMS) are described. The most widely used training course is the Basic Training Course for Emergency Medical Technicians (EMT's), published in Oct 1969, and recently revised. In order to assure that knowledge and skill proficiency are maintained, the EMT must take the EMT-Refresher Course (published in Mar 1971) every two or three years and even more often in rural areas or in services limited to non-emergency transportation. The Refresher Course is being revised and should be published in early 1978. The National Training Course for Emergency Medical Technician-Paramedic was completed in the summer of 1976. This training course is divided into 15 modules, each a complete, self-contained package directed toward attainment of skills and knowledge in a subject area. DOT has recently developed and published a training course for the EMT Dispatcher. The EMT Crash Victim Extrication Training Course was first published in 1974 and was designed to meet the needs of ambulance services that normally do not have a rescue unit accompanying them on traffic accidents. The course may also be used for the first responder, fire, and law enforcement personnel. Emergency medical care of the patient is not included in the course; it is assumed that the students have been certified as EMT's before taking the course. A revised edition of the course is to be published in early 1978. The original Crash Injury Management (CIM) Course was published in 1973 and has been well received by safety personnel; when revised in early 1978, it will be retitled Emergency Medical Care - First Responder.

by Robert E. Motley  
 Publ: Journal of Emergency Care and Transportation v6 n6 p105-7 (Nov-Dec 1977)  
 1977; 2refs  
 Availability: See publication

HS-023 536

### **VISIBILITY DISTANCE THROUGH HEAT ABSORBING GLASS**

A headlight visibility computer program (HVP) which is capable of determining the effects of many vehicle and environmental factors on visibility distance is introduced and applied to the determination of the distance at which pedestrians are first detected by drivers looking through clear and heat-absorbing glass. It was found that the decrement in visibility distance to a pedestrian due to the use of heat-absorbing glass

rather than clear glass varies from a low of 0% under certain glare conditions to a high of 12%. The average decrement due to heat-absorbing glass is 6%. Visibility distance was found to be more strongly affected by such vehicle factors as headlight dirt and headlight misaim than by the nature of the windshield glass. The roadway environment, i.e. road curvature, pedestrian location and reflectance, the presence of an oncoming glare vehicle, also affects visibility distance more strongly than the nature of the glass. (A discussion follows the article.)

by Arthur Bernstein

Publ: Journal of IES v7 n1 p168-76 (Apr 1978)

1978; 17refs

Presented at Annual IES Conference, New York, 28 Aug-2 Sep 1977.

Availability: See publication

HS-023 537

# **EFFECTS OF ENERGY CONSTRAINTS ON TRANSPORTATION SYSTEMS. PROCEEDINGS OF THE NATIONAL CONFERENCE (3RD) HELD AT UNION COLLEGE, AUG. 2-6, 1976**

The objectives of this conference on energy constraints on transportation systems, which was partially sponsored by the Energy Res. and Devel. Administration (ERDA), were presentation of an overview of the current state of the art in transportation energy research, enhancement of direct two-way communications on various energy and transportation topics among participants, discussion of the development of more trained manpower in the area of transportation and energy, and discussion of methods to make the public more knowledgeable of gains made in the transportation and energy sectors. Topics of discussion included the following: historical and forecast trends of energy consumption; energy consumption within the transportation sector; motivations and strategies for energy conservation plans; effects of various urban patterns on personal travel needs; innovative technological modes of transportation from the energy viewpoint; possible improvements in auto design and engine; interrelationships of environment, energy, and transportation; possible research topics; and role of Federal, state, and local agencies. The seminar was composed of a series of lectures, panel discussions, and question-and-answer sessions. Distinguished lecturers from various universities, research organizations, companies, consulting firms, and government (Federal and state) agencies were invited to participate. The major emphasis of the conference was "Conservation Options and Strategies for Implementation."

by Ram K. Mittal, ed.

Union Coll., Mechanical Engineering Dept., Schenectady, N.Y. 12308

Rept. No. ERDA-Conf-760895; 1977; 408p refs

Includes HS-023 538--HS-023 552. Conference sponsored in part by Energy Res. and Devel. Administration, Div. of Transportation Energy Conservation.

Availability: GPO, Stock No. 060-000-00073-5

HS-023 538

# **ENERGY CONSUMPTION IN THE TRANSPORTATION SECTOR**

Statistics on total energy inputs to the transportation sector in the U.S. covering the period 1947-1975 are presented. During

this time, the energy inputs have increased from 8820 trillion Btu to 18,355 trillion Btu, for an average annual growth rate of 2.6%. As with all energy, the rates of growth have been higher in the latter years of this period. Until 1966 the growth rate for energy consumption in transportation was lower than for the economy as a whole. This reversed in 1965; and, until 1970, the growth rate was higher for transportation. Energy consumption in the transportation sector accounted for 30.0% of the total gross energy inputs to the U.S. economy in 1975, and for 32.2% of the net energy input. Presently, petroleum accounts for 96.5% of the energy input to the transportation sector, and this dominance by petroleum is also expected to continue well into the future. The consumption of petroleum products (liquefied gases, jet fuel, lubes and waxes, gasoline, distillate fuel, and residual fuel) by the transportation sector over time (1960-1974) is documented in tabular form. Regional U.S. variations in transportation energy consumption for selected years (1960, 1965, 1970, and 1973) are also tabulated.

by Walter G. Dupree

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Publ: HS-023 537 (ERDA-Conf-760895), "Effects of Energy Constraints on Transportation Systems," Washington, D.C., 1977 p19-37

1977; 1ref

Presented at the third National Conference held at Union Coll., Schenectady, N.Y., 2-6 Aug 1976.

Availability: In HS-023 537

HS-023 539

# **ENERGY ANALYSIS FOR URBAN TRANSPORTATION SYSTEMS: A PRELIMINARY ASSESSMENT**

The capability of conventional urban transportation planning system (UTPS) planning procedures to deal with energy issues is discussed. Central energy-related issues for planning are identified as follows: reevaluation of long-range plans, modal alternatives, and investment needs and funding flow. The UTPS process is found to be capable of dealing quite well with certain energy policies such as speed reductions and increased vehicle efficiency, but generally is a weaker tool for addressing other policies such as rationing, Sunday driving bans, and urban activity redistributions. The sensitivity analysis of UTPS appears stronger than its capability to predict actual impacts. Specific information on gasoline price elasticity of travel by trip purpose, as well as trip priorities, would greatly increase the predictive power of the system. Research is needed to develop appropriate procedures for analyzing energy price and availability in long-range transportation planning, and to develop methods for the inclusion of energy/fuel factors in transportation programming and budgeting. The product of the research ought to be a set of procedures fully integrated with existing methods, to assist state and local transportation planning groups in preparing, updating, and revising energy-realistic transportation plans.

by David T. Hartgen

New York State Transportation Dept., Planning Res., Albany, N.Y.

Publ: HS-023 537 (ERDA-Conf-760895), "Effects of Energy Constraints on Transportation Systems," Washington, D.C., 1977 p39-49

1977; 3refs

Presented at the third National Conference held at Union Coll., Schenectady, N.Y., 2-6 Aug 1976. Previously presented

at 55th Annual Meeting of the Transportation Res. Board, Jan 1976.

Availability: In HS-023 537

HS-023 540

### **AN ENGINEERING ANALYSIS AND COMPARISON OF RAILROAD AND TRUCK LINE-HAUL WORK (ENERGY) REQUIREMENTS**

The propulsive work requirements of line-haul movement by rail and truck are compared in order to identify those characteristics of such movements which affect the absolute and relative amounts of energy required. Included in the analysis are rail movement in conventional cars, rail movement in truck trailers on flat cars (TOFC or piggyback), and over-the-road movement in various types of trailer trucks. Market or movement characteristics such as the weight and size of shipments, the average speed, and route profile conditions are varied. In order to identify the effects of varying mode and market characteristics, the work requirements are estimated using engineering relationships, in contrast to most prior comparisons which have used average empirical (statistical) data. These engineering models yield point estimates under certain profile conditions, while in others, where an excessive amount of data on the profile would be required, a few route parameters can be used to estimate a range of work requirements. These models should be generally useful in comparing energy requirements of transport modes. Final conclusions relate to the manner in which the energy implications of various changes in the transportation system are to be considered in planning studies. It seems that in many situations at the present time it is taken for granted that any shifting of traffic from over-the-road trucks to rail movement would result in a substantial saving in energy, the average fuel consumption ratio of 4:1 probably being the magnitude of the expected saving, although this is not specified often. The analyses presented in this study clearly indicate that such savings are probably overestimates in most situations, and in fact there may be no energy savings. Thus, if fuel conservation continues to be of high national priority, it is incumbent upon the profession to develop methods for the accurate estimation of changes in fuel consumption resulting from changes in the modal mix of freight movements, as well as changes in equipment design or operations within a single mode. The methods presented for work estimation, especially when combined with reliable fuel factors, should help fill this gap.

by Edward K. Morlok

University of Pennsylvania, Civil and Urban Engineering Dept., Philadelphia, Pa.

Publ: HS-023 537 (ERDA-Conf-760895), "Effects of Energy Constraints on Transportation Systems," Washington, D.C., 1977 p81-107

1977; 21refs

Presented at the third National Conference held at Union Coll., Schenectady, N.Y., 2-6 Aug 1976.

Availability: In HS-023 537

HS-023 541

### **WHY NOT TRIPLES? [TRIPLE TRAILER COMBINATIONS]**

A comprehensive study of transportation via triple trailer combinations supports their use in the U.S. trucking industry. The size and weight of commercial motor vehicles have been effec-

tively frozen since the adoption of the Federal Aid Highway Act of 1966. The removal of political barriers for the liberalization of these restrictions will help stem the tide of inflation, while at the same time making potential fuel savings of as much as 21% for intercity freight trucks a reality. With transportation a recurrent cost in every phase of production, distribution, and service, fuel becoming more expensive, and the security of supply more tenuous, the significant increase in transportation efficiency provided by the triple trailer combination must not be withheld from the nation's economy. Millions of operational miles have clearly demonstrated that the nation's highways have been built to the point where they can safely handle this equipment, with triples having established the best safety record of any vehicle used on the highways. Triples also make it possible to move freight with fewer vehicles, thereby reducing highway congestion, conserving energy, and consequently reducing pollution.

by Thomas D. Hutton, Jr.

Freightliner Corp., Portland, Oreg.

Publ: HS-023 537 (ERDA-Conf-760895), "Effects of Energy Constraints on Transportation Systems," Washington, D.C., 1977 p109-37

1977; 23refs

Presented at the third National Conference held at Union Coll., Schenectady, N.Y., 2-6 Aug 1976. Reprinted with permission from SAE, 1977.

Availability: In HS-023 537

HS-023 542

### **SELECTING LINE HAUL TRUCKS TO MEET FLEET REQUIREMENTS**

The process of selecting a truck to meet fleet requirements is discussed, and an example of this process using a computer simulation model is presented. Thousands of different truck combinations are possible; and, hence, the selection process becomes tedious. The simulation approach is demonstrated as a design tool for the selection of the optimum truck under the given conditions. Details of the truck components (engine, transmissions, driving axles, tires) and environmental factors (energy, noise level, smoke, wind) are provided. Several conservation options (use of radial tires, wind deflectors, thermatic fan) and their quantitative impact upon fuel savings are also considered. It is concluded that the simulation approach can be extremely useful in evaluating new components, a process that will cost several hundred dollars and will help avoid costly mistakes in truck specifications. An example of applying the simulation model is given for a short-haul carrier, Courier-Newsom, which is considering two new trucks (one with 270 hp, the other with 230 hp) as alternatives to its present trucks. The truck with a 230 hp engine, 9-speed transmission, 3.70 axle ratio, and radial tires on the tractor is found to be the best match to Courier-Newsom's requirements. It will use 15% less fuel than the present trucks. This recommendation is for only one specific leg in the Courier-Newsom system and is not a recommendation for the whole fleet.

by Donald A. Klokkenga

Cummins Engine Co., Inc., Columbus, Ind.

Publ: HS-023 537 (ERDA-Conf-760895), "Effects of Energy Constraints on Transportation Systems," Washington, D.C., 1977 p139-58

1977; 4refs

Presented at the third National Conference held at Union Coll., Schenectady, N.Y., 2-6 Aug 1976.

Availability: In HS-023 537

HS-023 543

### **FUTURE TRANSPORTATION FUELS-- OPTIMIZATION OF THE VEHICLE-FUEL- REFINERY SYSTEM**

Current U.S. energy demand and supply patterns are reviewed, and the availability of energy resources to meet demands in the free world is projected. At current petroleum industry capital investment levels, future U.S. crude oil production will not be sufficient to significantly reduce the level of petroleum imports. Synthetic fuels from such sources as oil shale, tar sands, and coal are also considered as replacements for imported petroleum. Conservation coupled with incentives for new petroleum and alternate resource development can substantially reduce the U.S. dependence on imported petroleum. Since transportation fuels account for a large portion of liquid fuels consumption, it is shown that the vehicle, its fuel, and the refinery (VFR) must be optimized as a total system in order to provide for the most efficient utilization of crude oil and subsequent synthetic-based fuels. Benefits to be derived from optimizing the VFR system are illustrated by a series of cases presented on the basis of applying known vehicle fuel economy efficiencies to various transportation product slates to simulate an average U.S. refinery. These computer runs show the relative fuel quantities available when a given refinery is operated to provide a fixed volume of non-automotive petroleum products and a fixed amount of transportation miles when using gasoline, diesel, broad-range fuel, and future concept engines. System optimizations similar to the VFR system study must be more broadly applied between the various energy sources and final-use devices to improve conservation in the entire spectrum of energy utilization.

by W. T. Tierney; R. F. Wilson

Texaco, Inc., Beacon, N.Y.

Publ: HS-023 537 (ERDA-Conf-760895), "Effects of Energy Constraints on Transportation Systems," Washington, D.C., 1977 p159-78

1977; 20refs

Presented at the third National Conference held at Union Coll., Schenectady, N.Y., 2-6 Aug 1976.

Availability: In HS-023 537

HS-023 544

### **THE ENERGY USE OF PUBLIC TRANSIT SYSTEMS**

The energy efficiency of various public transit systems is analyzed. Statistical as well as engineering approaches are discussed, with special emphasis on the impact of load factor upon energy efficiency. Comparative energy analysis is provided for the following systems: gasoline automobile (small, large), electric automobile (small, large), personal (private) rapid transit (PRT) (small, large), commuter rail, rail rapid transit, trolley (light rail vehicle (LRV)), fixed route bus, express bus, demand-responsive bus, and jitney. Data are tabulated for weight, number of seats, Btu per vehicle mile, and Btu per passenger mile. It is stated that the transportation planner should have both long-range and short-range plans in anticipation of energy shortages. Two obvious major long-range strategies are first, to design an overall system which minimizes energy use as much as possible; and second, to develop a system with as much diversity of energy forms as possible. A final strategy is to develop a system which has the capacity for short-range rapid shift from one mode to another in the event of shortages of one form of energy. Minimizing transportation energy cannot be a sole criterion for planning

decisions. It is, however, reasonable that every effort be made to minimize energy use for a given acceptable level of service, and this effort should include exploration of the following strategies: use lightweight vehicles, maximize vehicle loading, and use low-energy systems. In the end the transportation planner is left with the two basic energy questions: to what extent should energy be considered in the analysis of a new system, and what general energy relations apply in the comparison of alternative systems.

by Timothy J. Healy

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Publ: HS-023 537 (ERDA-Conf-760895), "Effects of Energy Constraints on Transportation Systems," Washington, D.C., 1977 p179-206

1977; 30refs

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Availability: In HS-023 537

HS-023 545

### **ENERGY EFFICIENCY OF CURRENT INTERCITY PASSENGER TRANSPORTATION MODES**

A detailed study was conducted to compare three public modes (aircraft, train, and bus) and one private mode (automobile) of intercity passenger transportation. The comparison represents Spring 1974 conditions. The study was conducted in two parts; first, basic energy efficiency data were collected or developed for each mode; second, these data were applied to passenger transportation between ten city pairs. The results were extended using national system trends to obtain a comparison for the total pair population. The importance of establishing clear ground rules to ensure fair comparisons through consistent data is emphasized; unlike this study, many earlier published analyses will not withstand close scrutiny and cannot be considered as fair comparisons. A number of pitfalls in making energy efficiency comparisons are outlined and concern the following: point in time the data are calculated, use of gross national statistics, use of idealized data for one mode and actual operational data for another, units of comparison, and circuitries for ground and air modes. This study attempted to produce fair energy efficiency comparisons for the Spring of 1974 for U.S. intercity passenger transportation modes; it is up to the transportation planner to decide whether and to what extent the data presented are applicable to his/her problems.

by Michael P. Miller

Boeing Commercial Airplane Co., Seattle, Wash.

Publ: HS-023 537 (ERDA-Conf-760895), "Effects of Energy Constraints on Transportation Systems," Washington, D.C., 1977 p245-68

1977; 31refs

Presented at the third National Conference held at Union Coll., Schenectady, N.Y., 2-6 Aug 1976. First published by American Inst. of Aeronautics and Astronautics as part of 1975 Annual Meeting proceedings.

Availability: In HS-023 537

HS-023 546

### **INTERCITY FREIGHT FUEL UTILIZATION AT LOW PACKAGE DENSITIES. AIRPLANES, EXPRESS TRAINS AND TRUCKS**

The transportation of low density commodities in airplanes, express trains, and trucks is analyzed in terms of modal ener-



gy utilization efficiency. Only operational energy consumption data are analyzed; secondary energy consumption such as apply to manufacturing and facilities operation are not considered. Intercity freight transportation modes serve significantly different markets; however, if comparisons are to be made, they should address the same transportation job. The modal efficiencies presented in this study are governed by transportation of low density freight, such as is carried by air. The comparative results are markedly different from those found in published analyses which ignore the characteristics of the markets served by each mode. Slow, large unit trains carrying high density freight may be energy efficient; however, such markets are not served by air transportation, neither do those trains ever approach the requirements of air freight markets. At average air freight density, typical express trains and typical trucks are respectively seven and four times more fuel efficient than air freighters; because of the significant quantities of freight carried in the bellies of passenger airplanes, air freighters do not necessarily represent a correct base for air cargo; the latter depends upon the passenger airplane trip fuel allocation technique. Freight density is only one market characteristic. Further work is needed to relate energy consumption to other features such as commodity value and trip time requirements. Perhaps a new unit of transportation energy efficiency should be developed, one which links the economic value of modal transportation service to energy consumption.

by Michael P. Miller

Boeing Commercial Airplane Co., Seattle, Wash.

Publ: HS-023 537 (ERDA-Conf-760895), "Effects of Energy Constraints on Transportation Systems," Washington, D.C., 1977 p269-96

1977; 25refs

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Availability: In HS-023 537

HS-023 547

## ENERGY AND FREIGHT MOVEMENT [TRUCKS]

Considerable detailed analysis of intercity freight movement by truck needs to be performed before conclusions regarding energy consumption for specific situations can be made. "Percent empty backhaul" and "ten miles per gallon" can be misleading. Shipping density and cubage are important determinants for comparing energy efficiency of various modes. Other characteristics of commodities such as value, perishability, fragility, frequency of shipment, amount to be shipped at one time, total amount to be shipped over a long period, are important factors while considering the energy efficiency comparisons over various modes. The rail piggybacking of highway trailers is one case where direct comparisons are possible. Available results of studies underway seem to indicate that when all fuel is accounted for, trailer on flat car (TOFC) and through truck service are about equal in fuel efficiency with differences dependent on characteristics of the corridor and the commodities involved. A study comparing truck and rail operations between Portland, Oreg. and Los Angeles, Calif. shows that the estimated total fuel consumption is nearly equal for truck and rail. Fuel for loading, transfer, and pickup and delivery is included. TOFC's appear to be least efficient at 250 gallons per 40-ft container equivalent, while trucks in the form of triple 27-ft trailers would be most fuel efficient if permitted, as they are in some areas. With all freight in boxcars, rail at 180 gallons is 5.3% more efficient than a 45-ft single

gallons is estimated to be 32% more fuel efficient than TOFC, and 5.6% more efficient than rail boxcar. For truck, over 60% of fuel consumption is attributed to payload movement compared to about 30% for rail. Trucks show a high proportion consumed by the power unit, but in the case of empty travel and equipment rate, truck proportions are smaller. The circuitry fuel represents 15% extra rail centerline miles between Portland and Los Angeles. Since trucks can travel the most direct route from basic origin to ultimate destination, it is doubtful that there are many corridors where highway mileage is substantially greater than rail centerline mileage.

by Alexander French

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Publ: HS-023 537 (ERDA-Conf-760895), "Effects of Energy Constraints on Transportation Systems," Washington, D.C., 1977 p305-21

1977; 3refs

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Availability: In HS-023 537

HS-023 548

## INTERCITY PASSENGER MODAL SHIFTS AS AN ENERGY CONSERVATION OPTION

To obtain data for use in its efforts toward contingency planning in the event of fuel shortages such as in late 1973 and early 1974, the Federal Energy Administration (FEA) sponsored a study to determine the extent to which travelers could be induced to shift from energy-intensive modes to more energy-efficient modes, in a manner which would save significant amounts of energy without causing a serious deterioration in transportation services. Intermodal shifts is one of three areas the FEA has identified in which it is thought possible to achieve reduction in fuel consumption in the intercity passenger transportation sector. The Northeast and California corridors were selected for analysis of the intermodal shift policy since it was felt necessary to study high travel density areas which had exhibited major historic changes in transportation system quality. Twenty-two scenarios (18 individual strategies and four combinations) were modeled for the 1982 time frame. Individual strategies include the following: adjustments of air fares through regulatory or tax actions, rail and bus fare reductions, auto cost increases, rail and bus block time improvements, reduced automobile availability, and reduced air service frequency. Results of the analysis of the various strategies are tabulated.

by Robert L. Bowles

Federal Energy Administration, Office of Conservation and Environment, Washington, D.C.

Publ: HS-023 537 (ERDA-Conf-760895), "Effects of Energy Constraints on Transportation Systems," Washington, D.C., 1977 p323-35

1977; 1ref

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Availability: In HS-023 537



HS-023 549

## TRANSPORTATION MANAGEMENT AND ENERGY CONSERVATION [FEDERAL POLICIES]

The energy conservation impacts of various transportation management policies such as those found in Federal programs are explored. The policies are aimed at influencing an individual's decision on whether to travel and by what mode, so as to result in, among other things, less energy being used in urban transportation. First, the role of mass transit in alleviating the energy dilemma is discussed. Mass transit is such a small part of the urban passenger transportation market that its immediate potential for energy conservation is limited. In fact, under the present situation, it seems that arresting the decline in transit ridership (resulting from the movement of the urban population to the suburbs, and the increase in automobile ownership) is a more reasonable goal for the transit industry than saving large amounts of transportation fuel. Because of the limited small supply and the relatively low demand elasticity of mass transit, carrot types of policies that are directed solely at shifting travel to mass transit through incentives will not have large impacts. Second, automobile control policies are discussed and include the following: restricted area licensing systems, parking taxes and surcharges, and automobile billing for roadway use. These automobile control policies have an important impact on encouraging high occupancy vehicles (carpools), in addition to their impact on reducing vehicular traffic altogether. Specific incentives designed expressly for carpool formation, which are perhaps more feasible to implement, can also be used (e.g. carpool matching programs). Program packages which incorporate incentives and disincentives are significantly more effective in reducing energy use than application of either alone. The reason is that incentives alone do not provide sufficient stimulus to motivate people in sufficient numbers to ride mass transit systems or share rides. Disincentives, on the other hand, do not guarantee individuals will have travel options other than the single occupant automobile.

by John G. Hemphill  
Federal Energy Administration, Div. for Conservation Policy,  
Washington, D.C.  
Publ: HS-023 537 (ERDA-Conf-760895), "Effects of Energy  
Constraints on Transportation Systems," Washington, D.C.,  
1977 p337-49  
1977; 8refs  
Presented at the third National Conference held at Union  
Coll., Schenectady, N.Y., 2-6 Aug 1976.  
Availability: In HS-023 537

HS-023 550

## A MARKETING APPROACH TO CARPOOL DEMAND ANALYSIS

A carpooling impact study was specifically designed to select representative policies and to assess their potential for reducing vehicle miles of travel (VMT) and energy consumption and their impacts on modal choice and pollution levels. The following types of policies to increase carpooling were applied to specific target groups and at levels representative of typical programs which would be administratively feasible: a gasoline rationing policy, four parking rate adjustment policies, a toll surcharge policy, a carpool rebate incentive policy, three improved carpool matching opportunity policies, two improved midday transportation availability policies, and nine sensitivity tests (focusing on changes in travel time components). It was

found that the effectiveness of certain policies is closely tied to the size of the market to which they are applied; some of the more important considerations are the numbers of persons who pay to park, the proportion of employment in major activity centers to large employers, and the characteristics and availability of parking facilities at the work place. The overall impact of policies that apply to the total population is generally greater than that of policies that apply only to specific groups, but secondary effects may increase the desirability of the latter. Alternate use of a vehicle left at home during the day is not significant and decreases energy savings only marginally. Of the policies tested, gasoline rationing had by far the greatest impact; energy savings for work travel were less than proportional to the level of rationing, indicating a willingness to reduce nonwork travel more substantially. Parking surcharge policies were highly effective in reducing energy consumption among the groups to which they were applied; the overall impact was directly related to the relative size of the affected group among all commuters. Gasoline surcharges achieved a reasonable degree of effectiveness, since they applied to all commuters rather than a specific market segment. Travel time changes that discriminate between carpool and single occupant modes have high potential; the overall effectiveness is closely related to the feasibility of implementing actual policies. Pure incentive policies such as rebates, improved matching, reduced parking rates for carpools, and improved midday transportation did not yield substantial energy savings.

by Donald M. Hill  
Peat, Marwick, Mitchell and Co., Washington, D.C.  
Publ: HS-023 537 (ERDA-Conf-760895), "Effects of Energy  
Constraints on Transportation Systems," Washington, D.C.,  
1977 p351-68  
1977  
Presented at the third National Conference held at Union  
Coll., Schenectady, N.Y., 2-6 Aug 1976. Sponsored by Federal  
Energy Administration.  
Availability: In HS-023 537

HS-023 551

## ENERGY AND ECONOMIC IMPACTS OF PROJECTED FREIGHT TRANSPORTATION IMPROVEMENTS

Current and future energy usage is assessed for each major freight mode (trucks, railroads, inland waterways (nonselfpropelled vessels), coastal and Great Lakes ships (selfpropelled and nonselfpropelled), pipelines, and air freight) by major commodity, and potential economic impacts of anticipated changes in freight systems under varying assumptions about freight transportation for 1980 and 1985 are identified. Attempts should be made to collect data which could enhance future studies related to energy conservation. Substantial opportunities exist for energy conservation in the freight transportation industry. The greatest opportunity for conservation lies with the industry itself. Government influence to improve energy conservation practices is not as potentially significant as opportunities currently available to industry. Government influence scenarios suggest that the marginal energy saving influence of government is half that of the trucking industry itself, and equal to about 60% of what the railroad industry can do on its own behalf by 1980. Government influence can double the 1985 contribution to truck but still amount to only half the percentage impact that carriers themselves can achieve. For railroads, however, government influence can almost equal the impact of the industry itself. Except for inland

waterways, where even government influence is small, no significant savings are anticipated as a result of an industry-acceptable level of government influence to improve energy conservation practices. In absolute terms, motor and rail carriers offer the greatest potential for energy savings.

by Robert H. Leilich  
Peat, Marwick, Mitchell and Co., Washington, D.C.  
Publ: HS-023 537 (ERDA-Conf-760895), "Effects of Energy Constraints on Transportation Systems," Washington, D.C., 1977 p369-93  
1977; 1ref  
Presented at the third National Conference held at Union Coll., Schenectady, N.Y., 2-6 Aug 1976.  
Availability: In HS-023 537

HS-023 552

### **RAIL-INTERMODAL OPERATION AND FUEL EFFICIENCY [CONRAIL]**

A brief description of some of the types of programs that the Conrail system is undertaking to improve its operations is provided, and some of the constraints on the profitability of Conrail's intermodal business are outlined. At present, Conrail is the largest piggyback operator in the U.S., with annual revenues in excess of \$300 million. An improved intermodal flatcar is needed. Conrail's present flatcar is too heavy and the trailers sit too high on the car, creating excessive drag which has a devastating impact on fuel efficiency. Unfortunately, there are more than 40,000 of these flatcars in service at this time. Another problem is track condition which makes it impossible for trains to maintain the degree of reliable operation that is required to capture a certain segment of the shipment market that presently utilizes trucks. Conrail's service reliability is being hurt even more because of the massive rehabilitation program it has underway. Beginning in 1979, however, Conrail's main line track should be in excellent condition and should be able to allow operation at a speed and reliability that has been absent from the bankrupt railroads for the past 25 years. As Conrail begins to shrink down its main line network, it is going to have to consider quite carefully whether or not intermodal should in fact be picking up a higher track occupancy factor due to the higher speed of its trains. Perhaps piggyback trains do not need to run faster than ordinary manifest freight trains, so long as intermodal's transit time reliability is good. A more mechanized, automated way to operate Conrail's intermodal terminals is needed. Another constraint to the growth of piggyback has been the requirement in the National Master Freight Agreement of the Teamsters Union that restricts trucking companies from utilizing rail piggyback services if any Teamster driver is adversely affected. It is still quite difficult for railroads to make tariff changes or open or close facilities without lengthy delays, and it is difficult to be sufficiently aggressive and flexible to meet market demands because of such constraints. Paradoxically, Conrail is being hurt by lack of regulation, in the form of competition by the unregulated segment of the trucking industry.

by Hugh L. Randall  
Conrail, Philadelphia, Pa.  
Publ: HS-023 537 (ERDA-Conf-760895), "Effects of Energy Constraints on Transportation Systems," Washington, D.C., 1977 p395-403  
1977  
Presented at the third National Conference held at Union Coll., Schenectady, N.Y., 2-6 Aug 1976.  
Availability: In HS-023 537

HS-023 553

### **VEHICLE EMISSION CONTROL. AMERICAN AUTOMOBILES, LIGHT DUTY TRUCKS, FOREIGN CARS. 3RD ED.**

This manual contains information about the emission control systems that are used on most cars and light-duty trucks manufactured in the U.S. (American Motors, Chrysler Corp., Ford Motor Co., General Motors, Dodge Truck, Ford Truck, GMC/Chevrolet Truck, International Motor Truck, and Jeep Truck), plus the seven most populous foreign-made cars sold for use in the U.S. (Datsun, Fiat, Opel, Renault, Toyota, Volkswagen, and Volvo). All the latest emission control systems, as well as carry-over systems from earlier years, are included. The purpose of the manual is to help the service technician maintain the effectiveness of the emission control systems on the vehicles he/she services. This will require not only checking system components for proper operation, but, more importantly, making sure the vehicle is tuned exactly to the manufacturer's specifications. With the many relatively complicated devices used on today's cars to keep emissions at a low level, this will require greater knowledge, skill, and accuracy than ever before. Because of the large volume of data on manufacturer's changes in the application of emission control systems to their various engines, this type of information is not included in the manual for practical reasons. The text material is arranged as follows: introduction (sources of automotive emissions, Federal Emission Standards, importance of the Vehicle Emission Control Information label), crankcase emissions (how crankcase emissions are formed, systems used to control them), exhaust emissions (basic ignition, carburetion, and engine performance characteristics that affect emissions; control systems used on most U.S.-built cars), evaporative emissions (control systems used), maintenance operations (general tests and tune-up procedures), truck emission control systems, and foreign car emission control systems. A number of diagnosis charts and testing procedures, as well as several pages defining terms, are also provided.

Gargano Publishing Co., 12824 W. Seven Mile Rd., Detroit, Mich. 48235  
1977; 192p  
Availability: Corporate author

HS-023 554

### **A BIKEWAY CRITERIA DIGEST. THE ABCD'S OF BIKEWAYS**

This report is primarily a condensation of four documents on bikeway planning, location, design, and safety (two user manuals, a state-of-the-art paper, and a final report) which were prepared for the Federal Hwy. Administration (FHWA). Additional references are provided, as well as a glossary. This digest is organized into four major, topical steps: planning, location, design, and operations. These steps progress from the bikeway planning stage through implementation and postconstruction, providing sufficient content to enable a planner or designer to establish a bikeway facility wherever desired. Planned and constructed bikeways are not always the solution to bicyclist's needs or desires; sometimes, a bikeway has an adverse impact on bicycle usage and the solution to problems or needs could have been resolved through legislation, law enforcement, or perhaps no action at all. This criteria digest first aids in determining whether a bikeway facility is needed; then, if a bikeway is found to be the answer, the digest tells how to

implement one. Estimation of bikeway use is based on consideration of the following: trip length; trip purpose (work, school, shopping, recreation); climate; age of riders; ownership of bicycles; and occupation or status of riders. Various criteria for locating bikeways include the following: potential use, basic width, connectivity, safety, grades, sight distance, pavement quality, imageability (appearance to the user as compared to what the facility actually is), air quality, noise, aerodynamics, costs and funding, competing uses, and security. Design characteristics include stopping sight distance, grades, widths and clearances, curves, intersections, grade separations, paving, drainage, and related facilities such as parking. Other factors to be considered include traffic control devices, signs, traffic signals, pavement markings, lighting, maintenance, and promotion of bikeway use.

Maryland State Hwy. Administration  
Rept. No. FHWA-TS-77-201; 1977?; 96p 14refs  
Availability: Federal Hwy. Administration, Washington, D.C.  
20590

HS-023 555

### **BANFIELD HIGH OCCUPANCY VEHICLE LANES. FINAL REPORT [BANFIELD FREEWAY, PORTLAND, OREGON]**

The Banfield Freeway in Portland, Oreg., was modified from a four-lane divided facility to a six-lane divided freeway with the median lane reserved for high-occupancy vehicles (HOV's) such as carpools and buses during peak hours. The shoulders were removed to allow the extra lane, and the lane widths for regular traffic were reduced to an average of 11.5 ft. Emergency pull-out bays were constructed at about 2000-ft (600-m) intervals. An 18.5 month period of HOV operation, from the opening of the preferential lanes on 15 Dec 1975, to Jun 1977, was evaluated. Results indicate that during the peak hours the number of three or more person carpools increased from 106 to 518, bus ridership increased from 300 to 633 persons per day, the violation rate was measured to be about 12%, and the accident rate is about the same as it was prior to the restricted lane operation. On an annual basis, an estimated 230,000 gallons (870,000 liters) of fuel are saved as a result of the HOV lanes, with a monetary savings of nearly \$143,000 for users of the lanes. The HOV lanes result in a travel time savings of 62,500 person hours and a savings in travel time costs of \$262,000 annually. A peak-hour analysis of pollutants from the Banfield Freeway traffic during HOV lane operation showed a 2% increase in carbon monoxide (CO) and hydrocarbon (HC) emissions over what would have been anticipated in traffic volumes, and a 10% increase in total vehicle occupants which are also greater than what would have been anticipated without the HOV lanes. Therefore, the freeway with the HOV lanes is moving more people with less pollution emitted on a per person basis than either before the HOV lanes were initiated or would be expected without the HOV lanes.

Oregon Dept. of Transportation, Metropolitan Branch,  
Transportation Bldg., Salem, Oreg. 97310  
DOT-FH-11-9127  
Rept. No. FHWA-RD-78-59; 1978; 129p  
Rept. for Dec 1975-Jul 1977.  
Availability: NTIS

HS-023 556

### **DRIVEN TO DRINK [TESTING OF THE EFFECT OF ALCOHOL ON DRIVING PERFORMANCE]**

Individual results are presented for five subjects who participated in drinking/driving tests that measured the effect of alcohol consumption on driving performance through a test course and, at the same time, on answering quickly and correctly a steady stream of simple questions. It is not possible to draw any solid conclusions from this experiment because the number of subjects was low, and the results statistically questionable. But the trends are obvious; the more one drinks, the less one is able to drive safely, to cope with distractions, and to make correct judgments. There were some inconsistencies; in two cases, the subjects performed, on the surface, better in some of their alcohol tests than when sober. In one case, this could be explained by the greater confidence the alcohol gave the subject, or by the result of greater familiarity with the test; in the other case, this outcome could be attributed to acclimatization, particularly to those questions which were repeated. In all other cases, deterioration was detectable in some aspect of driving performance. Even with the best portable breath analyzer available today, no better than a moderately good correlation exists between observed blood alcohol levels (BAL's) and the actual BAL's from blood samples. Convicting evidence in court should, therefore, continue to be confined to blood sample analysis. It may be concluded that alcohol consumed in large quantities greatly affects driving ability and low BAL's result in definite neurological deterioration. Even with BAL's below 80 mg/100 ml of blood, significant worsening of driver performance and capabilities was detected in enough subjects to suggest that this limit is too high. It is believed that a 50 mg/100 ml limit is fully justified. It is possible for a person after drinking alcohol to be legally fit to drive on the road, yet definitely less capable of doing so as safely as when sober. Interestingly, some of the subjects (none of whom knew how much they had drunk) still considered that they were fit to drive and thought that they had performed better in the tests than when sober.

by Rex Greenslade; Philip Jeune  
Publ: Motor v153 n3950 p50-1, 53-4 (24 Jun 1978)  
1978  
Safety Surveyed.  
Availability: See publication

HS-023 557

### **A BIOMECHANICAL ANALYSIS OF HEAD IMPACT INJURIES TO CHILDREN**

Head-first free-falls of 30 children, aged one to ten years, and one adult, 21 years of age, were studied to determine fall circumstances and injuries sustained. The falls of six children and one adult were selected for further analysis, and were simulated using the MVMA (Motor Vehicle Manufacturers Assoc.) 2-Dimensional Crash Victim Simulation computer model to estimate acceleration, force, and deflection profiles during impact. The data were examined to detect correlations between head injury severity for children and some of the physical parameters defining the head impacts. Such correlations are useful in establishing guidelines for designing a safer environment. Interiors of automobiles can be made so that crash injuries are minimized, helmets constructed to provide less injurious decelerations, and playgrounds designed so that fewer children sustain serious head injuries. There are no published studies that deal specifically with the biomechanics

of head impact injuries to children, and it cannot be assumed that head impact tolerance values for children are similar to those for adults, or that it is possible to extrapolate such values from the data available for adults. The data from this study show that head-first falls of children onto rigid surfaces from heights as low as 2 m can result in serious injuries (e.g. skull fractures and concussions). Conservative head injury tolerance limits are estimated to be 200-250 G for peak head acceleration. Acceleration-based parameters were found to have a better correlation with severity of injury than energy-based parameters. Children's body mass and orientation at impact have little influence on head loading during impact, although the injuries are influenced by the orientation. The effective head mass during impact is equal to the actual head mass for children under ten years of age, but it is more than twice the actual head mass for adults.

by Dinesh Mohan; Bruce Bowman; Richard G. Snyder; David R. Foust

Insurance Inst. for Hwy. Safety, Watergate 600, Washington, D.C. 20037; University of Michigan, Hwy. Safety Res. Inst., Ann Arbor, Mich.

1978; 45p 28refs

Presented at Workshop on Biomedical and Bioengineering Analysis of Head, Neck and Central Nervous System Injuries, 9th Annual Neuroelectric Society Meeting, Marco Beach, Fla., Dec 1977. Research sponsored by Insurance Inst. for Hwy. Safety. For a previous study on children's head injuries, see HS-022 483.

Availability: Insurance Inst. for Hwy. Safety, Watergate 600, Washington, D.C. 20037

HS-023 558

## **PARATRANSIT VEHICLE TEST AND EVALUATION. VOL. 5. NOISE TESTS. FINAL REPORT**

As one of five separate test series to evaluate two prototype paratransit vehicles (PTV's), procedures and results of noise tests are presented. The tests measured external vehicle noise during acceleration, constant speed, and stationary, at idle, conditions of the two prototype PTV's and a baseline vehicle (Chevrolet Nova). Interior noise at each of the passenger locations and in the driver's compartment was also measured under these conditions. The Nova baseline car was quieter than either of the two PTV's in all of the exterior tests. The Dutcher Industries' PTV was somewhat noisier than the ASL Engineering PTV in all tests. Neither of the two prototypes met the PTV design goals for the acceleration test or the stationary, at idle test, although both vehicles were well under the acceleration test limits recommended by SAE J986a. All three vehicles met the PTV design goals for the constant speed tests with one exception; the Dutcher PTV noise level at 30 mph was 4 dBA higher than the design goal. The noise levels of all three vehicles did not diminish more than 3-4 dBA in moving from a 5-ft to a 10-ft perimeter line for the stationary, at idle tests. The noise patterns of the Nova and ASL PTV are quite similar for the 5-ft and 10-ft perimeter lines; as might be expected, the rear-engine Dutcher is noisier at the rear and quieter at the front than are the Nova and ASL. Results of the interior noise tests show that most passenger and driver position levels in a particular vehicle are within 4-5 dBA of each other with the exception of the levels in the ASL during the acceleration test (driver's noise level was consistently 10 dBA or more higher than any of the passenger positions). As with the exterior noise levels, the Nova was quieter than either of the PTV's. The Dutcher was somewhat noisier than the ASL. Neither of the two prototypes met the PTV low-speed or high-

speed design goals, although the ASL did meet the low-speed goal during the stationary, at idle test. The increase in noise level with increasing velocity rises at a slightly higher rate in the two PTV's than it does in the Nova.

by L. Wesson; C. Culley; R. L. Anderson  
Dynamic Science, Inc., 1850 W. Pinnacle Peak Rd., Phoenix, Ariz. 85047  
DOT-TSC-1241  
Rept. No. UMTA-MA-06-0052-78-5; DOT-TSC-UMTA-77-49-5; 1978; 57p  
Rept. for Nov 1976-Jul 1977. Vols. 1-4 are HS-023 529--HS-023 532.  
Availability: NTIS

HS-023 559

## **HIGHWAY ACCIDENT REPORT. LONG TRANSPORTATION COMPANY, TRACTOR- SEMITRAILER COLLISION WITH MULTIPLE VEHICLES, VALLEY VIEW, OHIO, AUGUST 20, 1976**

About 7:04 P.M. on 20 Aug 1976, a tractor-semitrailer descending a steep grade in Valley View, Ohio, collided with ten automobiles that were stopped at a signalized intersection near the bottom of the grade; fire ensued; eight of the 27 automobile occupants died and 15 were injured; the truck driver sustained minor injuries. The National Transportation Safety Board (NTSB) determined that the probable cause of this accident was the inability of the improperly adjusted and partially inoperative service brake system on the tractor-semitrailer to slow the vehicle adequately as it descended the grade. Inadequate pre-trip inspections by the driver and the lack of required maintenance and inspection by the carrier failed to identify and to correct the unsafe condition of the brake system. The failure of the road signs to provide advance warning information concerning the length and steepness of the grade and the presence of the signalized intersection, prevented the driver from taking early evasive action. The NTSB made recommendations to the Dept. of Transportation, the Bureau of Motor Carrier Safety, and the State of Ohio, regarding advance warning signs, traffic control devices, accurate identification of accident locations on all roads and streets, roadside inspections of commercial motor vehicles, and safety compliance surveys of carrier operations.

National Transportation Safety Board, Bureau of Accident Investigation, Washington, D.C. 20594  
Rept. No. NTSB-HAR-77-3; PB-277 986; 1977; 29p  
Availability: NTIS

HS-023 561

## **MOTORCYCLES AND MOPEDS--TRAFFIC SAFETY AND CONSTRUCTION [MOTORCYKLAR OCH MOPEDER--TRAFIKSAKERHET OCH KONSTRUKTION]**

Results are reported for a study conducted by a working group founded by the Scandinavian Traffic Safety Council to examine the problems associated with the construction and performance of motorcycles and mopeds, in an effort to improve the traffic safety of these vehicles. The statutory regulations, technical requirements, and provisions concerning modifications for motorcycles and mopeds in Denmark, Finland, Norway, and Sweden are initially discussed. Next, the motorcycle and moped fleets in these countries are discussed with regard

to the types of vehicles which are most numerous and have the largest growth rates, and with regard to the performance of the most popular types of vehicles (standard performance, type testing of engines; modification methods, possible ways of modification, and possible means of protection; and different body structures). The people who own and use motorcycles and mopeds, and people who belong to motorcycle organizations are then examined. Following are discussions of the accident histories of motorcycles and mopeds in each of the countries, the common features of accident development in Scandinavia, and the relationship between accidents and motorcycle engine power. General views concerning motorcycle and moped driving with respect to drivers and risks, and isolation and possible solutions of the problems are presented. Finally, recommendations regarding two-wheeled motorized vehicles in general, and mopeds, light motorcycles, heavy motorcycles, and modified structures, in particular, are proposed. Of the special problems that arise in driving two-wheeled motorized vehicles, the acceleration capacity of modern motorcycles, above all, constitutes the greatest safety risk. For mopeds, the greatest problems concern the possibilities for modifying the vehicles and turning them into light motorcycles with considerable speed and acceleration capacity.

Nordisk Trafiksikkerheds Rad, Stockholm, Sweden  
Rept. No. NTR-13; 1975; 336p 12refs  
Text also in Swedish predominantly, with some sections in Danish and Norwegian (and accompanying summaries in Swedish, Finnish, and English).  
Availability: Reference copy only

HS-023 562

### AN ANALYSIS OF THE PROJECTION OF 1985 FUEL CONSUMPTION BY MOTOR VEHICLES

Research studies that project U.S. motor vehicle fuel consumption through 1985 are analyzed; the projections that are reviewed are those that are visibly used by policy makers and that contain well documented assumptions and methodologies. First, historical trends in motor vehicle fuel consumption are described, based on the most accepted public data (those prepared by the Federal Hwy. Administration (FHWA)). These data identify the categories of motor vehicles that consume the largest quantities of fuels. Next, research projects that contain projections of fuel consumption for the major fuel-consuming categories of motor vehicles are identified. Those projects with well documented assumptions and methods are described, and their projections are illustrated graphically as "reference projections." Other projections are then compared to these reference projections. Finally, the projections are aggregated to obtain an estimate of the total consumption of motor vehicle fuel in 1985. Substantial differences in the level of projected fuel consumption exist between even the most sophisticated econometric models incorporating similar policy assumptions. Future economic conditions may be more significant in determining the level of fuel consumption than policy alternatives presently being considered by Congress. In summary, 1985 gasoline consumption by all motor vehicles might lie between 83 and 112 billions of gallons, and 1985 diesel consumption might lie between 21 and 26 billions of gallons.

by John A. Anderson  
Motor Vehicle Manufacturers Assoc., Inc., Policy Analysis  
Dept., Washington, D.C.  
1978; 150p 25refs  
Availability: Corporate author

HS-023 563

### HIGHWAY STATISTICS 1976

As the 31st of an annual series, this publication presents the 1976 analyzed statistics of general interest on motor fuel, motor vehicles, driver licensing, highway user taxation, state highway finance, highway mileage, and Federal aid for highways; and 1975 highway finance data for municipalities, counties, townships, and other units of local government. The first three sections are devoted to motor fuel consumption and taxation, vehicle ownership and operation, and Federal excises and the Highway Trust Fund, respectively. The fourth section deals with the financing of highways by all government agencies. And the fifth section provides statistics on highway mileages. The tabulations in each section are briefly described in an accompanying text.

Federal Hwy. Administration, Hwy. Statistics Div.,  
Washington, D.C. 20590  
Rept. No. FHWA-HP-HS-76; 1977?; 170p refs  
Availability: GPO

HS-023 564

### COMPUTER-ASSISTED TRAFFIC ENGINEERING USING ASSIGNMENT, OPTIMAL SIGNAL SETTING, AND MODAL SPLIT. FINAL REPORT

A research effort was undertaken to determine if an integration of the techniques of traffic assignment, modal split demand analysis, and signal optimization is feasible. These three large-scale optimization techniques were combined in a set of computer-assisted traffic engineering programs and applied specifically to a study aimed at determining whether a "diamond lane" (prohibition of single passenger cars from the left lane) reduces energy consumption. The system optimization and user optimization traffic assignments are described. Travel time functions are presented for freeways, freeway entrance ramps, and signalized streets. Both single-vehicle and multiple-vehicle class (cars, carpools, and buses) formulations are described. Energy optimization is treated, and gasoline consumption functions for cars and buses are shown. Modal split analysis is described and integrated with the assignments so that the effect of favoring buses and carpools with diamond lanes can be measured. Some areas of required research are identified and include the following: user optimization; hybrid optimization; model credibility, validation, and calibration; application to larger networks; and programming and algorithm improvements. This approach to traffic engineering is practical; computer programs can be written to analyze major parts of the traffic networks of U.S. cities. Also, there are circumstances under which diamond lanes can save energy.

by Stanley B. Gershwin; John D. C. Little; Nathan Gartner  
Massachusetts Inst. of Tech., Cambridge, Mass. 02139  
DOT-TSC-849  
Rept. No. DOT-TSC-RSPA-78-10; 1978; 97p 66refs  
Rept. for Apr 1975-Sep 1977.  
Availability: NTIS

HS-023 565

### FRANCE'S TOUGH ENERGY PROGRAM PUTS THE HEAT ON THE ADMEN [ADVERTISING]

As part of what is probably the most extensive and highly organized energy-saving campaign of any Western country,

France's government has decided to censor advertising campaigns that encourage energy consumption. The censorship of advertising that whets the appetite for energy-using products is part of the grand strategy that France adopted early in 1974 in an effort to reduce the country's dependence on oil imports, which were accounting for about two-thirds of energy consumption. The instrument for making people change their behavior is the Energy Conservation Agency (ECA), created in late 1974, and whose objectives on the advertising front are to eliminate blatant appeals to consume more energy, to sensitize the public to a conservation ethic, and to keep the public better informed about aspects of the energy situation that should shape anyone's decision to use (or not use) energy. ECA's main targets have been the oil companies, the auto manufacturers, and the government's own electric power monopoly. It is difficult to determine if France's advertising crackdown has been effective because it would be impossible to separate out its consequences from the rest of the country's war on energy waste, which includes large investment grants to industries and homeowners, a "tax" on industrial energy consumption above specified levels, and an armada of inspectors who fine building managers when they allow temperatures to go too high. In any case, comparing France's success in energy conservation with that of other nations, it uses only two thirds as much energy for each unit of gross national product (GNP) as Britain does, and only half as much as the U.S.

by Daniel Yergin

Publ: Fortune p106-8, 112 (17 Jul 1978)

1978

Availability: See publication

HS-023 566

## AUTOMOTIVE VEHICLES OF THE FUTURE

Automobiles of the future are discussed, based largely on the work done at Minicars, Inc. under the Research Safety Vehicle (RSV) Prog. of the National Hwy. Traffic Safety Administration (NHTSA). Through this research, Minicars has achieved a unique and practical perspective allowing it to relate advanced motor vehicle design concepts to government rulemaking requirements in the specific areas of fuel economy, emissions, and safety. Furthermore, the company can relate the design concepts to the technological and financial requirements of the industry. Weight reduction offers the most hope for improving fuel economy, as well as for achieving acceptable levels of vehicle performance and overall energy efficiency, with the low-powered advanced propulsion systems that are under development. A more difficult, riskier, longer-term, capital-intensive, but practical and more effective approach to weight reduction than decreasing vehicle size is to alter the structural architecture (e.g. use of lightweight materials such as thin-gauge sheet metal and urethane plastics). The propulsion system raises emissions/economy/performance trade-off problems. In the near term, it is expected that there will be an emphasis on smaller engines, four to six cylinders, mounted transversely to gain crush space and turbocharged, especially diesels or stratified-charged internal combustion engines (ICE). Electric vehicles are not expected to be competitive with the ICE before the end of this century. The power transmission subsystem, however, permits some innovative maneuvering, allowing an operation closer to optimal efficiency (e.g. electronic control). Electronic sophistication, especially in safety devices (e.g. microprocessor/radar combination for a collision-mitigation device), is no more than a decade away. Fuel

economy can also be increased by improving aerodynamic configuration (lowering of the drag coefficient to the 0.3-to-0.4 range and thus increasing fuel efficiency by 3 to 5 mpg). The Minicars RSV is an example of what can be accomplished in vehicle design and development in the near future by using new material and technology. The four-passenger and six-passenger vehicles meet all of the government regulations for 1985.

by Donald Friedman

Publ: Transportation Research News n76 p8-10 (May-Jun 1978)

1978

Based on a paper presented at 57th Annual Meeting of the Transportation Res. Board, Washington, D.C., Jan 1978.

Availability: See publication

HS-023 567

## DRUG USERS AND DRIVING BEHAVIORS

Summaries of the latest experimental and epidemiological research on the interactions between psychological drugs and driving behaviors are presented. Bibliographic citations and summaries (giving purpose, methodology, results, and conclusions) are presented for 76 documents. Each summary is accompanied by a table specifying (when indicated) type of drug, sample size, sample type, age, sex, ethnicity, geographical area, methodology, data collection instrument, date(s) conducted, and number of references. The experimental studies, which make up most of the presentation, deal with the effects of drugs on cognition, coordination, reaction time, and other psychomotor functions, all of which are related to driving performance. Some of the experimental studies described involve driving simulators, while others are concerned with real driving situations. The epidemiological studies deal primarily with investigations of drug-involved auto accidents. First, a list of all the studies is presented alphabetically by author. This is followed by the main text which is organized into three sections (reviews, epidemiological studies, experimental studies), each containing the study summaries arranged alphabetically by author. A supplemental bibliography and subject/author indexes are also provided.

by Gregory A. Austin, ed.; Robert S. Sterling-Smith, ed.; Mary A. Macari, ed.; Dan J. Lettieri, ed.

Documentation Associates Information Services, Inc., 11720

W. Pico Blvd., Los Angeles, Calif. 90064; Massachusetts

General Hosp., Dept. of Psychiatry; National Inst. on Drug

Abuse, Div. of Res., 11400 Rockville Pike, Rockville, Md.

20852

NIDA-271-75-3071

Rept. No. DHEW-(ADM)-77-508; Research-Issues-20; 1977;

181p 158refs

Availability: GPO \$1.70, Stock No. 017-024-00640-8

HS-023 568

## NIGHTTIME LEGIBILITY OF GUIDE SIGNS. FINAL REPORT

Nighttime legend, panel, and surrounding brightnesses were measured on 120 out of a total of 3200 large guide signs (New York State Categories D4 "Advance Exit Sign," D5 "Exit Direction Sign" and D6-0 "Overhead Gore Sign") throughout New York State to evaluate their legibility under headlight illumination. Panel and legend condition, background brightness, and sign legibility were rated subjectively; and sign age, material type, and sign position were recorded. Brightness was

January 31, 1979

HS-023 571

highly variable, and generally below that required for optimum legibility. Examination of measured brightness data in terms of established legibility/brightness relationships indicated that many signs did not provide adequate nighttime legibility, particularly in areas of high ambient illumination. This was confirmed by subjective ratings of nighttime legibility. While differences in brightness were apparent between enclosed-lens-sheeting and corner-cube-button legends, and between overhead-mounted and shoulder-mounted signs, these differences had little effect on legibility. Although the number of signs in those categories was small, older signs and those with deteriorated legends may have been markedly lower in legibility. The measured contrast between legend and panel brightness was low for many signs, and this condition appeared to have an adverse effect on legibility. The target value of many large guide signs was limited by high surrounding brightness, and by blockage by other highway features.

by Kenneth C. Hahn; Earl D. McNaught; James E. Bryden  
New York State Dept. of Transportation, Engineering Res.  
and Devel. Bureau, State Campus, Albany, N.Y. 12232  
HPR-FCP-40T1-042

Rept. No. PB-276 992; NYSDOT-ERD-77-RR50; 1977; 62p  
11refs

Prepared in cooperation with Federal Hwy. Administration.  
Availability: NTIS

which was highly influenced by occupation, was the best predictor of drinking and driving.

by Robert E. Booth; Ralph A. Grosswiler  
Publ: International Journal of the Addictions v13 n1 p79-88  
(1978)  
1978; 6refs  
Availability: See publication

HS-023 571

## **MANAGEMENT OF THE TRAFFIC CRASH RISK: THE ROLE OF GOVERNMENT**

During the last ten years, some premises were formulated which influenced decisionmaking and included the following: solutions to highway safety problems known, Federal intervention able to solve local highway safety problems, uniformity a virtue, problem identification as the key, research primarily to support mission objectives, conduct of demonstration projects, and an appropriate state response to be created by the 402 program. The solution of highway safety problems has proven to be very complex. Federal personnel have demonstrated some insensitivity to the nature and environment of state and local highway safety programs. The narrow focus on problem identification has resulted in countermeasure development that is closely related to the crash phase of an accident. The nation's highway safety research program has tended to follow the funding. Demonstration programs have been mounted without an adequate theoretical foundation or sound program planning, and state grant programs have not achieved their potential. Some new premises should be considered, including the following: highway safety as an important local problem, unavailability of simple solutions for the conditions that create traffic crashes, highway safety program management primarily a responsibility of state and local government, Federal funds necessary to develop state and local management and program structures, knowledge/information/technology for reducing risks of traffic crashes needed to be in a form that is useful and understandable by local program managers, and need for research programs to be broadened to include analysis of all aspects of the highway safety process. For the future, the efforts of the Federal government should be focused on tasks that can best be accomplished centrally, tasks that will facilitate and support the action programs at the state and local level. Indirect support should also continue. The Federal role should also facilitate and support interstate activity and lead the effort to create an accurate understanding of the true magnitude of the traffic crash risk. For the state and local governments, their basic responsibility is to develop, implement, and manage programs to reduce the risk of traffic crashes.

by Kent B. Joscelyn  
University of Michigan, Hwy. Safety Res. Inst., Ann Arbor,  
Mich.  
1977; 17p  
Presented at 1977 Annual Meeting of National Conference of  
Governor's Hwy. Safety Representatives, Dearborn, Mich., 10  
Oct 1977.  
Availability: Corporate author

HS-023 570

## **CORRELATES AND PREDICTORS OF RECIDIVISM AMONG DRINKING DRIVERS**

Follow-up interviews of 47 formal DUI (driving under the influence) clients of an alcohol treatment program were conducted in an effort to find predictors of success. Predictors included historical features occurring at the time of arrest, stressful events since treatment, length of treatment, time since treatment, and demographic data. Recidivism was conceptualized as a multidimensional construct through selfreport measures and arrest records. While the study was not one of treatment per se, the observation that greater time in treatment was significantly correlated with less drinking and driving, and near significance for fewer rearrests, speaks to the importance of increased therapy for recidivism reduction. Not surprisingly, greater time since treatment was positively correlated with recidivism, indicating the need to increase follow-up study time periods in order more accurately to assess recidivism. The analysis of demographic variables and their relationship to outcome revealed that those clients least likely to be recidivists were older, better educated, married, widowed, or separated, and in either a white-collar profession or had no profession. Skilled manual laborers reported the most involvement in drinking and driving and were the occupational group most likely to be rearrested. With respect to events occurring at the time of arrest, going to jail, losing a driver's license, being fined, or being financially burdened, had no effect on outcome. Receiving a suspended sentence did relate, but not quite significantly, and in the direction of regression. On the other hand, individuals responding affirmatively to involvement in a car accident were drinking less, had changed more in their drinking behavior, and at the point of the interview were making more money relative to their coming to treatment than nonaccident-involved clients. Similarly, in the analysis of outcome predictors, the best predictor of drinking behavior change was the presence of a car accident. Income level,



HS-023 572

### AN INVESTIGATION OF FUEL ECONOMY POTENTIAL OF SIX 1976-MODEL VEHICLES

Experimental work was performed to determine the fuel-economy potential of eighteen 1976 model automobiles representing six different models ranging in weight from 3000 to 5000 lb. (Chevrolet Vega, Dodge Dart, Chevrolet Nova, Ford Granada, Ford Torino, and Chevrolet Impala). The fuel-economy potential was determined by adjusting the engines to best fuel economy achievable with acceptable driveability but without constraints on emissions. Comparable data obtained on the vehicles adjusted per manufacturers' specifications provided baseline data from which to quantify fuel-economy differential brought about by imposing emission controls to meet 1976 Federal emission standards. Fuel economy (combined city/highway) for the six test vehicle models averaged 8.6% better than that for the baseline vehicles. For the individual vehicle models, fuel economy improved from 4.3% to 14.1%. Hydrocarbon (HC) emissions for the six test models ranged from 1.45 g/mile to 2.55 g/mile (0.90 g/km to 1.58 g/km) with the six-vehicle average 2.08 g/mile (1.29 g/km). For the baseline vehicles, HC emissions were below the 1976 Federal emission standard of 1.5 g/mile. Oxides of nitrogen (NOx) ranged from 3.77 g/mile to 11.3 g/mile (2.34 g/km to 7.02 g/km) for the six test vehicles. The average NOx level for all the test models was 6.84 g/mile (4.25 g/km). NOx emissions for the baseline cars were below the 1976 Federal emission standard of 3.1 g/mile. Carbon monoxide (CO) emissions for the six test models ranged from 3.07 g/mile to 20.2 g/mile (3.15 g/km to 12.6 g/km), the average being 8.37 g/mile (5.20 g/km). HC and CO emissions for the six test models were reduced to 0.68 g/mile (0.42 g/km) and 2.74 g/mile (1.70 g/km), respectively, when catalytic converters were installed on the cars adjusted to best economy. The catalytic converter had little or no effect on NOx emissions or fuel economy. Fuel economy at steady-state speeds with the best economy adjustments averaged about 7.9% better than that for the baseline vehicles with emission control constraints.

by R. D. Fleming; A. D. Campbell  
Energy Res. and Devel. Administration, Bartlesville Energy  
Res. Center, Bartlesville, Okla.  
Rept. No. BERC/RI-77/5; 1977; 54p 13refs  
Availability: NTIS \$4.50 paper copy, \$3.00 microfiche

HS-023 573

### SPECIAL SURVEY ON PEDESTRIAN ACCIDENTS FOR AGES 0-14

In conjunction with the 1976 AAA (American Automobile Association) Pedestrian Safety Inventory program, a survey was undertaken to collect and analyze data related to accidents involving child pedestrians from birth to 14 years. The accidents were analyzed in one-year increments from birth through age fourteen rather than grouping the data into five-year increments in order to determine more accurately the critical ages for providing traffic accident prevention education. Depending on city size, pedestrian accidents involving children from birth through age six ranged from a low of 18% to a high of 25.7%. Almost one of every two pedestrian accidents involved children under age fifteen. One child in 45 under age fifteen was killed as a result of involvement in a pedestrian accident. Pedestrian injury accidents peaked at age five and decreased steadily after age six. At ages four and five, children were much more likely to be killed when they became involved in

pedestrian accidents. Almost two of every three of the child pedestrian victims were male. Approximately three of every four child pedestrian accidents occurred at non-intersection locations. Finally, more than eight out of every ten child pedestrian accidents occurred during daylight hours.

by Sylvia P. Ross  
Publ: Pedestrian Safety Report n6 (1978)  
1978; 8p  
Availability: See publication

HS-023 574

### THE YOUNG DRIVER PARADOX

A discussion is presented of the young driver paradox, i.e. as necessary experience is increased, so is exposure to risk, and, in parallel, as likelihood of crash involvement goes down with experience, exposure to risk goes up. Experience, or exposure-oriented countermeasures aimed at the young driver will, therefore, have little or no effectiveness, since the gains along the one dimension (e.g. experience) may result in and be offset by losses along the second. In that regard, the case of the young or perhaps, newly licensed driver is unique; the young driver is the only driver whose exposure-to-risk factor and driver-experience risk factor are both extreme. One factor exerts a multiplier effect on the other risk factor in determining the total risk of the young driver, whereas for every other age group of drivers, a divisor effect is apparent. To be effective, any young-driver countermeasure must of necessity take into account this paradox and the nature of the trade-offs. Two current countermeasures, probationary licensing for young drivers and tougher licensing standards, are seen potentially as having a limited likelihood of success, and possibly even negative consequences. Two possible countermeasures, however, which appear likely to minimize the trade-offs involved are driver education and a novel form of restricted licenses. Vastly improved driver education (or driver training) is seen as offering the greatest potential future countermeasure defined in terms of accident reduction. Greatly increasing the pre-high-risk driver experience of young drivers will manifest a multiplier effect in terms of reductions in the serious accidents of both impaired and non-impaired young drivers. A second countermeasure, which would also circumvent the young driver paradox, is the granting of restricted permits to newly licensed drivers. For example, to the extent that exposure to risk is lower during the hours of 5:00 A.M. to 9:00 P.M., young drivers would be able to accumulate their experience at times when the objective risk of serious collision is lower. Additionally, as the greatest frequency of driving-while-impaired (and serious impaired-driver accidents) occurs during the hours of 10:00 P.M. to 3:00 A.M., restricted permits would necessarily separate the young drivers from the enormous impairment risk factors.

by R. A. Warren; H. M. Simpson  
Traffic Injury Res. Foundation of Canada, 1765 St. Laurent  
Blvd., Ottawa, Ont. K1G 3V4, Canada  
1976; 15p 5refs  
TIRF Issues in Rd. Safety.  
Availability: Corporate author \$3.00



January 31, 1979

HS-023 578

HS-023 575

### **THE SELF-SUPPORTING TIRE: A NEW CONCEPT IN VEHICLE MOBILITY**

The three-phase program (conventional tire studies, tire support system investigations, and refining the final self-supporting tire system) in the development of the BFG (BFGoodrich) Self-Supporting Tire system is described. Insert systems such as rubber beads, polyurethane, and spun steel with lubricant were considered, but the design chosen was one in which the necessary support is given by the tire structure itself. When the tire is uninflated, the carcass is able to carry the entire load without collapsing. The tire/wheel system consists of only two components: a modified one-piece rim, and a specially-designed radial passenger car tire which structurally supports itself at zero inflation pressure. The new tire system has successfully met or exceeded the original design guidelines established for it, which include the following: simplicity (as few separate components as possible), uninflated mobility of at least 25 miles at 25 mph), sizing of system to be applicable to existing vehicles, one-piece wheel, four-tire system weight to be less than conventional five-tire system, and conventional mounting and dismounting. The BFG Self-Supporting Tire system provides a new level of mobility and convenience along with potential savings in vehicle space and weight. The current objective is to continue refining the concept until it is comparable in inflated performance to conventional radial tires.

by John T. Alden  
BF Goodrich Co.  
Rept. No. SAE-770349; 1977; 10p 3refs  
Presented at International Automotive Engineering Congress and Exposition, Detroit, 28 Feb-4 Mar 1977.  
Availability: SAE

HS-023 576

### **EVALUATING PICTOGRAPHIC SYMBOLS: AN AUTOMOTIVE APPLICATION**

Fifty university students participated in a laboratory experiment which examined 19 pictographic symbols previously used or proposed for labeling automobile controls and displays. The symbols were for seat belt, charging circuit, choke, horn, fuel, coolant temperature, engine oil, front hood, rear hood, front fog lights, rear fog lights, parking lights, ventilating fan, lower beam, upper beam, turn signal, windshield wiper, windshield washer, and hazard warning. Association norms, measures of familiarity, and magnitude estimates of the symbols' communicativeness were collected. Twenty subjects also participated in a paired-associate learning task and a two-alternative, forced-choice reaction-time task in which they made same/different judgments in response to verbally presented symbol labels followed by visually presented pictograms. In general, the relative order of merit for the individual symbols was not consistent across tasks. Specifically, ratings of communicativeness were found to be well correlated with associative strength and to a lesser extent with reaction time, but associative strength was only weakly correlated with reaction time. Ease of learning was found to be an independent measure. This examination of alternative methods of evaluating symbols has emphasized the need for empirical testing of alternatives. For the development of symbol sets that are to have a significant impact on a large population, the symbols should undergo several stages of evaluation prior to adoption.

The choice of quantitative evaluation methods will depend on the conditions under which they will be used.

by Paul Green; Richard W. Pew  
F44620-72-C-0019  
Publ: Human Factors v20 n1 p103-14 (Feb 1978)  
1978; 26refs  
Availability: See publication

HS-023 577

### **CLOSED-CIRCUIT TELEVISION--THE TIRELESS INSPECTOR [PRODUCTION INSPECTION OF AUTOMOTIVE PARTS]**

Various closed-circuit television (CCTV) systems being used today to inspect products such as integrated circuit chips, electrical components, medical devices, automotive parts, and hot-rolled steel strip, are described. In the simplest form, the part being inspected is displayed on a cathode-ray tube (CRT) screen for visual observation by an operator who makes the go/no-go decision. In more sophisticated systems, computer or microprocessor-based controllers accept video signals from the TV camera and make the go/no-go decision based on preset acceptance criteria. The operator is only required to load and unload parts and deal with unusual situations. These sophisticated systems often include a self-test capability to alert the operator to any system aberrations. An automotive parts manufacturer uses the CCTV system to inspect ball studs for automotive ball joints, primarily to determine whether or not the cotter pin hole is present and if so, if it is located at the correct distance from the end of the thread.

by Donald E. Hegland  
Production Engineering  
Rept. No. SAE-770347; 1977; 11p  
Presented at International Automotive Engineering Congress and Exposition, Detroit, 28 Feb-4 Mar 1977.  
Availability: SAE

HS-023 578

### **ALCOHOL RELATED CASUALTIES AND ALCOHOL BEVERAGE MARKET RESPONSE TO BEVERAGE ALCOHOL AVAILABILITY POLICIES IN MICHIGAN. VOL. 2. A CRITICAL REVIEW OF SOCIAL COST ESTIMATION OF ALCOHOL PROBLEMS. FINAL REPORT**

Work conducted to satisfy the following four objectives is reported: review the social cost literature for appropriate models for estimating the social cost of alcohol abuse, identify the criteria and methodological issues for a valid social cost study, discuss the major economic theories and principles utilized in a social cost study, and make recommendations regarding the feasibility of implementing a system for estimating the comparative social costs of alcoholism and alcohol abuse at the state level. Social costs include foregone output or lost productivity, determination of which requires a model of social behavior that causally links cost-incurring behavior with the social problem. A cost-tracking system is diagrammed. It is concluded that alcohol-related problems, not being exclusively caused by alcohol abuse, require additional research before social cost estimation of such problem areas will be of high utility for the planning and evaluation of state and local intervention and prevention programs. It is in the best interest of the state to wait for valid comparative cost estimates, and only to

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become invested in the process of computing them when the utility of the activity will serve a real purpose in planning and evaluating intervention and prevention programs. Factors which must be resolved before initiating a social cost study include discounting and discount rates, productivity increases, allowance for consumption, and the value of nonmarket production.

by Jay Alan Freedman; Richard L. Douglass  
University of Michigan, Hwy. Safety Res. Inst., Systems  
Analysis Div., Ann Arbor, Mich. 48109  
MDPH-384117  
Rept. No. PB-276 045; UM-HSRI-77-37-2; 1977; 43p 42refs  
Rept. for Oct 1976-Sep 1977. Vol. 1 is HS-021 470.  
Availability: NTIS

HS-023 595

### COMPARATIVE COSTS OF URBAN TRANSPORTATION SYSTEMS. FINAL REPORT

Twenty-five modal combinations are studied which are the permutations of the separate modes, combined as necessary to provide door-to-door transportation service in large, urbanized areas. The modes that are combined serve all or part of the door-to-door trip. Those modes providing partial service must be supplemented by other modes providing access and/or egress services. Fully integrated modes, which provide door-to-door service without transfers, do not need supplementary services and include single occupant automobile, carpool, two forms of rapid bus, and conventional bus. Partially integrated modes requiring access or egress modes include rail rapid transit and some forms of rapid bus. Line-haul-only service may be provided by the rail rapid transit and rapid bus, to which both access and egress services must be added. Residential access modes are feeder bus, park-and-ride (PAR) auto, and kiss-and-ride (KAR) auto. The central business district (CBD) egress modes are feeder bus and rail rapid downtown distributor. The major modes studied have been costed for an abstract city corridor, one eighth of a circular city, with a ten-mile radius serving a one-square-mile CBD. The population of the entire city is assumed to be between one and two million inhabitants. No single system is optimal over all conditions. Trade-offs are required among time, money, and other environmental and societal costs. Four modal combinations are found to minimize time and/or cost. These are single occupant automobile (fastest, expensive), carpool (fast, inexpensive), fully integrated rapid bus with surface distribution (slow, inexpensive), and conventional bus (slowest, most inexpensive). Rail rapid modes are expensive, but fast. Construction costs of fixed capital investment for transit modes are a major determinant of the feasibility of transit services in a given corridor. Automobile-based modes are land-hungry; even with the assumption of reversible freeways, these modes require ten times the land for line-haul service than is required by the transit modes.

by Louise E. Skinner  
Federal Hwy. Administration, Washington, D.C. 20590  
1978; 113p  
Based on three papers by Kiran U. Bhatt of the Urban Inst.  
under contract DOT-FH-11-7994.  
Availability: GPO, Stock No. 050-001-00137-3

HSL 79-0

HS-023 596

### STATE-OF-THE-ART ASSESSMENT OF ELECTRIC AND HYBRID VEHICLES

Information was collected on over one third of an estimated 2000 American-built electric vehicles of all types currently operating in the U.S. and Canada. Test results presented are for 29 vehicles, of which 22 were all-electric, 2 were hybrid, and 5 were conventional counterparts. Electric vehicle performance differed greatly from one manufacturer's vehicle to another, because of the great variety of chassis, propulsion systems, and components in use. For almost all the vehicles tested, range decreased approximately linearly with increasing speed. Energy consumption measurements made at the test track were lower than those reported by users of electric vehicles. Regenerative braking increased range, generally by an average of 13%. Acceleration, maximum speed, and grade-climbing capability of electric vehicles were generally lower than those of conventional vehicles. Many electric vehicles have limited payload capability. Maximum range is determined by use patterns (speed, stops, topography), and by the operator's driving style. The majority of vehicles are recharged daily, usually overnight. Life cycle costs appear to be relatively high, and user experience to date shows lower vehicle reliability for electric vehicles than for conventional ones. A substantial number of electric vehicles have been built by converting conventional heat engines, but a greater number have been built "from the ground up." In the U.S. the electric vehicle industry is immature and small; fewer than 33% of the manufacturers building today were building electric vehicles three years ago. Where appropriate consideration has been given to electric vehicle capabilities and applications, results have been successful. This is particularly true for the English delivery vans, the U.S. Postal Service van and many buses. Extensive propulsion system optimization is needed, in addition to the design of components specifically for these vehicles. Hybrid vehicles are heavier and more costly than electric vehicles since a heat engine and an electric propulsion system are required. Generally these vehicles were designed not to save fuel, but to reduce emissions. Data are limited since only about 20 vehicles have been built. Only two were tested: a Volkswagen hybrid taxi and a Kordesch vehicle. No hybrids are known to be in commercial operation in the U.S. today, although there are a few buses in Europe and Japan, and a few vans in Japan. Their capabilities are largely unexplored.

National Aeronautics and Space Administration, Lewis Res.  
Center, Cleveland, Ohio 44135  
Rept. No. NASA-TM-73756; CONS/1011-1; 1977; 596p refs  
Prepared for Energy Res. and Devel. Administration, Div. of  
Transportation Energy Conservation, under Interagency  
Agreement EC-77-A-31-1011.  
Availability: NTIS

HS-023 597

### A SURVEY OF AMERICAN ATTITUDES TOWARD TRANSPORTATION. FINAL REPORT

Results of a major survey to examine the attitudes of American citizens toward transportation problems, as well as descriptive material on the sampling techniques involved, are presented. The survey used a specially designed sample of 1538 people, chosen to represent a valid cross section of the American adult population. The survey focused on determining the habits of Americans in using public and private transportation. It also covered the perceived relationships between trans-

portation and other national issues, as well as specific attitudes toward individual modes. The results are presented in the following sections: basic mood and attitudes of the American people, basic transportation habits, commuting (carpools, public transit commuting), buses, attitudes toward transportation services (ratings of transportation services generally, volunteered transportation problems and needs, assessments of different kinds of transportation facilities (interstate highways and freeways, bridges, major roads and major streets, buses, minor roads and side streets, intercity passenger railroads, commuter rail/subways), financing highways and public transit, the 55 mph speed limit), fixed rail transportation, and looking ahead (reactions to changes in gasoline prices, effects of forms of gasoline rationing, effect of commuter parking tax, reactions to proposals for decreasing gasoline consumption, fringe parking, air bags, proposals for reducing fuel consumption and encouraging public transportation use, airline service). Appendices contain information on the sample (philosophy used in sample design, stratification of the national sample, sampling error, overview, weighting), interview dates and timing (current trends, mass transit, energy bill, energy vs. environment, Middle East, weather), and overview of respondents. Extensive tabulation of results is provided; the margins of the text denote pertinent tables.

Peter D. Hart Res. Associates, Inc., 1529 O St., N.W., Washington, D.C. 20005  
DOT-OS-80025  
Rept. No. DOT-I-78-1; 1978; 249p 2refs  
Rept. for Nov 1977-Jan 1978.  
Availability: NTIS

HS-023 598

### **NATION'S USED CAR SALES TOP \$21 BILLION ANNUALLY, STUDY SHOWS**

In this news release, statistics on used car sales in the U.S. compiled from a survey conducted by the Hertz Corp. covering the period 1967-1976, are presented. Nearly three out of four U.S. passenger cars purchased for personal driving are second-hand, and an average of 13.5 million used cars have been retailed annually over the past ten years. Motorists now spend more than \$21.3 billion a year for "previously-owned" autos, with franchised new car dealers accounting for over \$14 billion in sales. It is estimated that more than 20% of the used cars are sold privately. On a unit basis, franchised new car dealers retail just over half of all second-hand models, while used car dealers account for just under 30% of the annual turnover. The average new domestic make is kept 3.57 years and runs nearly 53,000 miles before it is first traded; but during its normal 9 1/2 year lifetime, the typical car has three separate owners. Typical purchase prices for one-to-four-year-old used cars range from 20% to 80% below new-auto outlays, while savings on operating expenses run 10% to 50% under typical new-car operating expenditures. To achieve maximum potential savings, a used car should be kept at least three years, at an assumed 10,000 miles-per-year of travel. Of all new U.S. cars sold, only about 12% are traded after just one year of use; another 14% are sold at the end of two years. The high point comes in the third year, with nearly 17% of the cars traded; another 14.5% are first sold after four years of operation. Of the 23.1 million new and used, domestic and imported passenger cars sold in the U.S. each year, about 18.2 million go into personal use by private individuals, while some 4.9 million enter nonpersonal service of some type. More than 13.2 million of the personal-service cars are used units, almost 73%

of the total. It is indicated that U.S. cars may last longer, and travel farther, than generally believed in the past. Even after ten years of operation, 40%-45% of the units are still on the road. Fewer than 1% of used cars are not re-registered after two years of operation; even after five years of service, only about 10% have been removed from service. By the end of the 15th year, some 95% of the originally-registered models have been retired from operation. Also to be taken into consideration is the fact that more than 30% of cars stolen in the U.S. are not recovered.

Hertz Corp., Public Affairs Dept., 660 Madison Ave., New York, N.Y. 10023  
1978; 9p refs  
Availability: Corporate author

HS-023 599

### **MVMA OFFICERS TELLS OF PUSH FOR NEW TRUCK SAFETY RESEARCH [MOTOR VEHICLE MANUFACTURERS ASSOCIATION]**

One of the best methods of ensuring fair and balanced laws or regulations is to use solid research information manufacturers and truck users can share with government and industry as building blocks for better understanding of the problems involved. The motor vehicle research program of the Motor Vehicle Manufacturers Assoc. (MVMA), conducted largely through grants and contracts, has been directed toward a better definition of the traffic safety problem and better understanding of those factors that cause accidents and injuries on the highway. The objective has been to expand information and knowledge bearing on traffic safety problems so that effective countermeasures can be developed. The MVMA's motor truck research program budget for fiscal 1979 is in the following six parts: braking and handling, heavy truck accident analysis, light truck accident data collection and analysis, heavy truck tire nonuniformity, truck ride quality, and emissions and noise research. Truck accident data collection and analysis projects will include the following: a sample of underride injury accidents for detailed study using accident reports, photographs, and interviews with investigative offices; the effect of conspicuity on truck underride accident involvement; a study comparing cab-over-engine tractors with conventional truck tractor safety; a study to obtain more data on accidents involving double and/or triple trailer combinations; an investigation of the effects of heavy trucks on highway maintenance; a study of the tire uniformity parameters relating to ride quality, braking, and handling; and a monitoring of the Federal government's expansive research program into truck ride quality and the impact on driver performance. Additional projects should be concentrated in the following fields: development of separate reporting and evaluating procedures for large and small trucks; development and maintenance of in-depth large truck accident studies; studies on methods for improving police reporting and collection of data on large truck accidents; development of more effective motor truck inspection procedures; and development of comprehensive training, registration, and licensing procedures for truck drivers. Exchange of ideas, information, and views is needed as well as continu-

ing dialog between the MVMA and the American Trucking Associations (ATA).

by Peter G. Griskivich

Publ: Transport Topics n2239 p11 (10 Jul 1978)  
1978

Presented at Annual Meeting of the American Trucking Associations' Council of Safety Supervisors, Kansas City, Mo., 14 Jun 1978.

Availability: See publication

HS-023 600

### CYLINDER HEAD AND VALVE SERVICE

Information and step-by-step procedures (and accompanying illustrations) for servicing cylinder heads and valves are presented for the auto service specialist's use. Directions for servicing are presented in the following sections: replacing the cylinder head; installing the cylinder head; valve service (adjusting the valve clearance on engines with mechanical lifters, adjusting hydraulic valve lifters (stud-mounted rocker arm valve adjustment, cold valve adjustment, warm head adjustment)); rocker arms (servicing rocker arms, rocker arm studs, push rods); and disassembling the cylinder head (replacing the valves (removing overhead valves, installing overhead valves, inspecting the valves, valve breakage), valve guides (reaming the valve guides, measuring valve stem-to-guide clearance), valve springs (testing valve springs, replacing valve springs, overhead valve springs, valve spring installed height), grinding valve stems (proper hydraulic lifter clearance, valve grinding (electric valve face grinder, electric valve seat grinder, hand grinding (lapping)), valve tappet service, and reassembling the cylinder head). Separate sections provide outlines of tips on gasket installation, and thread repair (including spark plug threads).

Publ: Motor v149 n1 pER31-9 (Jan 1978)  
1978

Availability: See publication

HS-023 601

### DIAGNOSING ENGINE PROBLEMS

A step-by-step outline for diagnosing engine problems is presented for the auto service specialist. A logical progression from symptom to symptom (engine misses at all speeds, engine misses at low or idle speeds, poor high speed performance or lack of power, valve noise, detonation (ping or spark knock), external engine oil leakage, and internal engine oil leakage (indicated by blue smoke emitting from the tailpipe)), with probable causes and remedies, is presented in 47 steps.

Publ: Motor v149 n1 pER25-8 (Jan 1978)  
1978

Availability: See publication

HS-023 602

### BRUSHING UP ON BASICS [AUTOMOBILE ENGINE COMPONENTS]

The basic components of the engine and how they function are outlined and illustrated for the auto service specialist. This explanation of how an automobile engine works is divided into

the following sections: engine construction; cylinder numbering (and firing order); engine operation (intake, compression, power, exhaust); combustion; heating the fuel/air mixture; valve timing; cylinder head gaskets; valve system; valve action; valve tappets (lifters), mechanical and hydraulic; camshaft; locating the valves; valve springs; cylinder bore; piston rings (compression ring design, compression ring types, two important changes (reverse twist ring, and the radius face or barrel face ring), oil ring design, ring coatings, service pointers); crankshaft and main bearings; and why a cooling system.

Publ: Motor v149 n1 PER11-22 (Jan 1978)  
1978

Availability: See publication

HS-023 603

### VEHICLE AERODYNAMICS: THE NEXT FUEL ECONOMY FRONTIER

Aerodynamic improvements are becoming critical elements in the search for enhanced passenger car fuel economy. Volkswagen researchers have developed computer simulations showing that refinements in body shape yield better payoff than reductions in vehicle weight. This research also highlights VW's Detail Optimization technique, used to take basic styling elements several steps further in terms of improved aerodynamics. But the real payoff in fuel economy comes with initial designs optimized for aerodynamic benefits. Each 3.5% of drag reduction appears to translate into about 1% of fuel economy gain. General Motors' researchers have shown how a popular body shape, the hatchback, can have excessive drag created by a critical slope angle. Their evaluations of parameter sensitivities indicate that this phenomenon persists, despite changes in several factors relevant to road-vehicle aerodynamics. (free-stream turbulence, Reynolds Number, ground proximity, yaw, and rounded upper edge). One implication of the GM research is that slippery shapes are not necessarily as efficient as they appear.

Publ: Automotive Engineering v86 n7 p19-24 (Jul 1978)  
1978

Based on SAE-780265 "Aerodynamic Improvements--A Great Potential for Better Fuel Economy," by L. J. Janssen and H. J. Emmelmann; and SAE-780267 "Aerodynamic Drag of Bluff Body Shapes Characteristic of Hatchback Cars," by Thomas Morel, both presented at SAE Congress, Detroit, 27 Feb-3 Mar 1978.

Availability: See publication

HS-023 604

### DO WE HAVE A CHOICE? [FUTURE OF AUTOMOTIVE TRANSPORTATION, FUELS, AND POWER PLANTS]

Future prospects for automotive fuel supplies and alternative vehicle engines in the U.S. are considered. The U.S. cannot be certain that worldwide petroleum production will continue to rise to match demand even at higher prices. There may be short-term actual surpluses of oil on the world market, but the long-run projection is clearly in the direction of shortages unless demand is curtailed. The principal effect of higher prices is likely to be the use of advanced technology to recover more in-place oil, raising the level of recovered oil from a given field from a U.S. average of 32% to 40% or more. Yet this extra production will be from known reserves and is already

accounted for in supply estimates. Higher energy prices can balance supply and demand only to the extent that they stimulate increased production or lower demand. Petroleum production will increase (but at a declining rate) as prices rise; eventually it will decline regardless of price. On the demand side, even the steep price rises instituted by OPEC (Organization of Petroleum Exporting Countries) had relatively little impact on consumption. Gasoline use, in particular, appears to be relatively price inelastic in current price ranges. If demand remains price inelastic, the upper limit of pricing will only be reached when substitutes such as oil shale become price-justified. Societies have almost always opted to consume resources in the present if they have significant value. Transportation dependence on petroleum can be reduced through use of liquid fuels such as those derived from synthetic crude (from coal or oil shale), or alcohols (from coal or biomass). These fuels would be more expensive, but are suitable for use in either external or internal combustion engines. Among the uncertainties which the potential synthetic fuel industry in the U.S. must consider are as follows: actual amounts of natural crude that can be found and extracted at costs less than syn-crude, rate at which world petroleum prices rise compared with time it takes to go from exploration to production of syn-crude, the time when syn-crudes may be less costly than OPEC oil, the possibility that OPEC might reduce prices of natural crude drastically, and the question of whether U.S. energy policy will remain stable enough to accept the risk of producing high cost crude oils. With respect to alternative automotive powerplants (e.g. Stirling engine, gas turbine), a clear consensus on developments of future power sources for motor vehicles has yet to emerge. State-of-the-art electric vehicles have far too many disadvantages to compete in a significant way with heat engines. Widespread introduction of alternative powerplants may require extensive modification of the revenue base of state governments, a large percentage of which depends on fuel taxes.

Publ: Automotive Engineering v86 n7 p26-31 (Jul 1978)  
1978

Based on a Maryland Dept. of Transportation report "The Outlook for Automotive Fuel Supplies, Alternative Vehicle Engines, and Potential Implications for Transportation Tax Structures (1985-2000)," by William Barron, Edwin Crawford, and Morton Weinberg, Feb 1978.

Availability: See publication

HS-023 605

## WHO'S RESPONSIBLE FOR EMISSIONS AFTER 50,000 MILES?

Major changes may be required in the Federal Motor Vehicle Control Program (FMVCP) if health-related air quality problems occur due to emissions from post-50,000-mile automobiles. Among the changes are the following: inclusion of one or more catalyst replacements in the car's original price, regulation of the price of unleaded gasoline to make it comparable with that of leaded, and enforcement of antitampering prohibitions at commercial repair facilities. A sensitivity model was developed by the Environmental Protection Agency (EPA) to estimate emissions from catalyst-equipped cars as a function of several variables. The rate of catalyst removal or destruction was found to be the dominant parameter, with the rate of engine malmaintenance second. Catalyst-equipped vehicles have demonstrated good performance, driveability, and fuel economy, and the government would like to assume that catalyst removal would not occur. Though quantification is difficult, it is known that catalyst converter removal does occur

and will. Including the price of a replacement catalyst is the only tangible incentive for the vehicle owner to make this replacement himself/herself. The equalization of leaded and unleaded gas prices should eliminate the incentive for removing the filler neck restrictors to allow use of the cheaper fuel (thus rendering the catalyst virtually useless). According to the government, the ultimate solution would seem to be some combination of a provision in the car price for a replacement catalyst, equalization of fuel prices, and improved inspection/maintenance (I/M) as the cornerstone. One such I/M option would include the following: enforce antitampering to discourage deliberate catalyst removal; require a 100,000-mile or actual lifetime catalyst warranty to encourage proper maintenance, if coupled with I/M (make I/M more palatable by reducing individual consumer repair costs for failures, and extend design life of catalysts); and generate inspection programs which include catalyst checks to make it increasingly difficult to pass unless the catalyst is present and operative.

Publ: Automotive Engineering v86 n7 p32-5 (Jul 1978)  
1978

Based on SAE-780027 "Emissions from Catalyst Cars Beyond 50,000 Miles and the Implications for the Federal Motor Vehicle Control Program," by Michael P. Walsh and Barry D. Nussbaum, presented at SAE Congress, Detroit, 27 Feb-3 Mar 1978.

Availability: See publication

HS-023 606

## RISK ANALYSIS OFFERS NEW ENGINEERING TOOL [AUTOMOTIVE ENGINEERING]

Engineering risk analysis, a method which may well provide a fruitful approach to meeting the often conflicting requirements of automotive regulation, liability protection, and cost-effective design, is described. Engineering risk analysis combines several methodologies to quantify a system's optimum design, manufacture, or operation. In overview, this methodology consists of assembling a logical schematic of the system (a fault tree logic model), identifying its critical elements, quantifying the elements probabilistically (events expected to occur, events for which other hard data exist, events beyond the limits of resolution, and events that are strongly conditional), and using the completed model to assess the system's cost/benefit trade-offs. Results may involve system reliability or availability, critical failure modes, characteristic breakdown of the system in terms of component failures, or payoffs of design redundancy. A hypothetical example of the economics of a product design change in terms of warranty claims and exposure to recall is presented.

Publ: Automotive Engineering v86 n7 p40-4 (Jul 1978)  
1978

Based on SAE-780165 "The Quantification of Risk in Processes and Products," by Thomas H. Pratt; SAE-780166 "The Synthesis of Fault Trees," by Steven A. Lapp and Gary J. Powers; and SAE-780167 "An Overview of Risk Analysis Methodology," by A. Adnan Aswad, all of which were presented at SAE Congress, Detroit, 27 Feb-3 Mar 1978.

Availability: See publication

HS-023 607

HSL 79-01

HS-023 607

### **EGR LOWERS DIESEL NOX EMISSIONS [EXHAUST GAS RECIRCULATION; NITROGEN OXIDES]**

Robert Bosch G.m.b.H. (West Germany) engineers have developed an exhaust gas recirculation (EGR) system which may help future diesel vehicles achieve lower NO<sub>x</sub> (nitrogen oxides) emissions. The use of EGR, though requiring precise controls, has been found effective by employing a system which senses both air and fuel flow and limits EGR to provide clean combustion. The EGR system consists of the following two principal components: a mixture control unit consisting of air-flow and fuel-flow sensors, and a throttle valve with actuator for the control of the recirculated exhaust gas. The position of the throttle valve determines the air-exhaust gas ratio of the cylinder charge. The throttle valve is regulated by the mixture-control unit so that a set air/fuel ratio is maintained. In the mixture-control unit, the air-flow sensor and the fuel-flow sensor are connected by a lever, so that when the travel of the sensor plate in the air-flow sensor increases, the cross section of the variable slit throttle of the fuel-flow sensor is increased. The air-flow sensor is now tuned with the fuel-flow sensor so that, when the desired air/fuel ratio is reached, there is a constant pressure drop at the slit throttle for each chosen quantity of fuel. This tuning is achieved by shaping the air funnel of the air-flow sensor. Constant volume sampling (CVS) tests using four different types of diesel vehicles were conducted. The use of EGR allowed the NO<sub>x</sub> emission on three vehicles to be reduced by 37%-60% without increasing the initial HC (hydrocarbon) emission. On the fourth vehicle, the NO<sub>x</sub> emission could only be reduced at the expense of the HC emission. The effect of injection timing on NO<sub>x</sub> and HC emissions without EGR, and with a constant setting of the EGR system, on the four vehicles was also studied. When EGR is used, notably lower NO<sub>x</sub> emissions are achieved for the same HC emissions than when the start of injection is set later. The drivability did not deteriorate for any of the vehicles with EGR as long as the HC emission remained below 0.41 g/mile.

Publ: Automotive Engineering v86 n7 p46-51 (Jul 1978)  
1978

Based on SAE-780222 "An Exhaust Gas Recirculation System for Diesel Engines" by Gerhard Stumpp and Werner Banzhaf, presented at SAE Congress, Detroit, 27 Feb-3 Mar 1978.

Availability: See publication

HS-023 608

### **OVERDRIVE AUTOMATIC FEATURES MULTI-FUNCTIONAL ELEMENTS**

Toyota's new four-speed automatic transmission, the A4OD, features 0.689:1 overdrive for improved fuel economy and reduced engine noise. This is brought about by fitting an added planetary gear set between torque converter and conventional three-speed automatic. Clutches in the overdrive serve the following two purposes: handle engagement and disengagement during 3-OD and OD-3 shifts, and work selectively to smooth shifting of the conventional unit. The transmission, standard on Toyota's top-line Cressida, has a dash-mounted overdrive lockout as well, to preclude any hunting sensation in certain vehicle modes. Design of the A4OD, developed jointly with Aisin Warner Ltd., is an outgrowth of Toyota's A4O three-speed automatic. The new transmission weighs 60.1 kg, and is suitable for engine torques up to 196 N.m (145 lb.ft) and engine speeds up to 6000 rpm. The Cressida has a 1245-kg curb weight, and is powered by a six-cylinder, 2.6-L engine produc-

ing 80 kW (108 hp) at 5000 rpm and 182 N.m (134 lb.ft) of torque at 2400 rpm. With the A4OD, there is, in general, an across-the-board decrease of 2 dBA in interior noise traceable to reduced engine speeds. With regard to fuel economy, the overdrive transmission improved EPA city figures by some 2.5% and highway values almost 21%. Combined fuel economy for both overdrive-equipped Cressida wagons and sedans is about 10.8 L/100 km (22 mpg); engineers estimate that the new overdrive accounts for a 20% improvement compared to baseline vehicle data.

Publ: Automotive Engineering v86 n7 p56-9 (Jul 1978)  
1978

Based on SAE-780097 "Toyota Four-Speed Automatic Transmission With Overdrive," by A. Numazawa, S. Kubo, Y. Shindo, and S. Moroto, presented at SAE Congress, Detroit, 27 Feb-3 Mar 1978.

Availability: See publication

HS-023 609

### **AUTODEPOSITION: A NEW APPROACH TO STEEL COATINGS**

Amchem Products has developed a corrosion preventive technique relying on chemical attack of the metal substrate and the use of reaction products to deposit a latex polymer which forms a continuous film on curing. This concept for applying organic films to steel surfaces via auto-deposition requires immersion process steps, though spray stages are used in cleaning and rinsing. Most current processes for the corrosion protection of steel use zinc phosphate conversion coatings followed by chrome rinsing and an organic film-forming material. Paint suppliers have tried to eliminate the need for conversion coating steps. Autodeposition has reached production and, as currently used, does not require a separate conversion coating. The saving of 30%-50% of the energy used by conventional priming or painting methods for steel makes its four-year production history seem timely and attractive. Autodeposition is not ideal for all applications, but it offers a potential for eliminating fire hazards, has low space demands, and possesses unlimited throw power. The process consists of the following six basic steps: cleaning, rinsing, coating, rinsing, reaction rinsing, and curing. While there are many ways to handle these steps in process design, the application of autodeposited films makes critical demands on the way these steps are organized.

Publ: Automotive Engineering v86 n7 p52-5 (Jul 1978)  
1978

Based on SAE-780188 "Autodeposition--A New Process for Controlling Corrosion," by Harry M. Leister, presented at SAE Congress, Detroit, 27 Feb-3 Mar 1978.

Availability: See publication

HS-023 610

### **BATTERY AND FUEL CELL TECHNOLOGY SURVEYED [ELECTRIC VEHICLES]**

Batteries which are currently being produced in the laboratory are projected to be available in the 1980-1990 time frame. Much of the development work on secondary batteries in the U.S. is directed toward production of batteries to power electric vehicles and to load-level electric utilities. The Dept. of Energy (DOE) sponsors a large part of this effort via its battery development budget authority, which amounted to \$7.5 million in 1976 and \$12.7 million in 1977. Under a separate

law, the Electric and Hybrid Vehicle Research, Development, and Demonstration Act of 1976, additional funding was authorized for electric vehicle battery development. The Argonne National Lab. is assisting DOE with management and coordination of industrial contacts for design and cost studies of near-term electric vehicle batteries which include lead/acid, nickel/zinc, silver/zinc, and nickel/iron types. Also, DOE and private industry are sponsoring significant work in advanced lithium metal sulfide (lithium-aluminum/iron-sulfide, lithium-silicon/iron sulfide), sodium-sulfur, and zinc/chlorine batteries. U.S. effort is also being directed toward development of high-energy primary batteries for both commercial and military use. The two most important types are lithium/sulfur dioxide and lithium/thionyl chloride. With regard to fuel cells, hydrogen/oxygen fuel cells (hydrogen/oxygen with alkaline electrolyte, hydrogen/oxygen with solid polymer electrolyte) are the most highly developed type and have been used in the Apollo Space Shuttle programs and the Navy's Deep Submergence Rescue Vehicle and the Deep Quest Vehicle. Hydrazine/hydrogen peroxide fuel cells have been developed in France for experimental use in undersea vehicles; although their efficiency is not as high as that of hydrogen/oxygen cells, their reactants are liquid under normal temperatures and pressure and are easier to store than hydrogen and oxygen.

Publ: Automotive Engineering v86 n7 p68-72 (Jul 1978)  
1978

Based on SAE-780703 "Survey of Power Systems for Small Undersea Vehicles," by Thomas J. Lund and Joseph F. McCartney, presented at SAE West Coast Meeting, San Diego, 7-10 Aug 1978.

Availability: See publication

HS-023 611

### BASIC CAR CARE

A collection of basic automotive maintenance hints and easy-to-do checks that will make it easier for the newer driver to get along with his/her vehicle, is presented. The following topics are covered: wet engine, clogged carburetor jet, broken distributor rotor, hot wiring, cleaning ignition points, need of new shocks, tightly fitting gas tank cap, checking cranking vacuum when trouble shooting, oil leakage, spare keys, car repair costs, best mechanic, telltale leaks, fuel filters, hose problems, speedometer cables, water in the trunk, and procedures for working with fiberglass resin or plastic body fillers. Photographs are provided to demonstrate various automotive problems and maintenance procedures.

Publ: Driver v12 n1 p20/6 (Jun 1978)  
1978; 1ref

Availability: See publication

HS-023 612

### THE CHP EL CAJON AREA'S OFF-HIGHWAY VEHICLE REGISTRATION/ENFORCEMENT PROGRAM [CALIFORNIA HIGHWAY PATROL]

In an attempt to enforce registration provisions for off-highway vehicles (OHV), personnel from El Cajon Area CHP (California Hwy. Patrol) and the La Mesa DMV (Dept. of Motor Vehicles) office conducted their second annual Off-Highway Vehicle Registration/Enforcement Program on the desert floor in Ocotillo Wells, approximately 70 miles east of El Cajon in the Anza-Borrego Desert, over the three-day

Washington's Birthday weekend, 1978. This is the only program of its kind in the state. The registration portion of the program is unique in that it can handle the entire registration process in about 20 minutes. Those who have proper documentation for their vehicles can pay registration fees, apply for duplicate title, get VIN (vehicle identification number) plates assigned, and receive off-highway ID stickers; this process normally takes two days or more. Even if the registered owners do not have proper documentation for their vehicles, DMV issues a temporary operating permit and gives the owners a checklist of items to be completed prior to finalizing the registration process. It is the feeling of most of the OHV registration team that although the public-relations aspect enhanced the image of DMV and CHP, providing the public an excellent opportunity to talk with CHP officers in a positive environment, the most valuable aspect was enforcement. Now OHV people are used to seeing CHP officers taking enforcement action, and although there are some who still voice opposition, compliance with OHV laws was much better in 1978. Another benefit of the program is the transfer of knowledge between CHP and DMV personnel. CHP officers gained insight into the complicated registration process while DMV personnel gained valuable knowledge about VIN's and safety equipment. An overall evaluation of the program reveals that although many OHV enthusiasts appreciate the convenience of the program, some are against any form of regulation. The need for enforcement has been demonstrated by the high number of accidents, the most common accident victim being one who has been drinking. The overall effect of the enforcement phase of the program will not become known for a while. This type of program requires a long time to develop, but it is a positive approach to the OHV phenomenon.

by Harvey Smith

Publ: California Highway Patrolman v42 n5 p11, 50, 52-3 (Jul 1978)  
1978

Availability: See publication

HS-023 613

### ALCOHOLISM: HOW IT AFFECTS SENIOR CITIZEN DRIVERS AND PEDESTRIANS

No hard and fast statistics are available today concerning the number of elderly drivers and pedestrians who have alcohol-abuse problems. These are the "unmentionables," senior citizens who drink to excess and drive, or pedestrians who walk carelessly into traffic. Present data indicate alcoholic older adults comprise 10% of senior citizens, but law enforcement agencies report that when more reliable data are obtained, the rate will go higher. The drinking couples are by far the worst offenders. A facet of today's driving that visibly affects most senior citizens at the wheel is their resistance to accepting their physical limitations, and changes in traffic rules. All too often, the final results of the elderly who drink and drive are predictable. The difficulty with the aging drinking driver is that he/she is rightfully allowed all privileges of the road, and is fully aware of them, but is equally blind to the fact that by indulging in alcoholic beverages, he/she is endangering the lives of others. About a decade and a half ago, an accident prevention director of an insurance company advocated mandatory reexaminations of any driver whose driving record indicates that something may be wrong. It was stated that physical condition, knowledge of traffic regulations and driving techniques, plus the willingness to adjust to



changes in driving requirements, are the three special areas of driver performance which should necessarily be checked periodically in all drivers. However, there was one aspect missing from this advice, a warning of the danger of alcohol, to senior-citizen drivers especially. Many of the situations in which senior citizens live cause an increased amount of idle time, in which personal and social drinking can slip from harmless imbibing to outright addiction. Drinking patterns can deteriorate perceptibly, and the senior citizens may find their only peaceful moments in motoring, wherever the roads lead them. There is help for the drinking driver. There are in-service programs available, programs where experts work directly with the elderly in their own homes. Senior citizens, as well as everyone, must be made to realize that drinking and driving do not mix.

by Ben B. Berkey

Publ: California Highway Patrolman v42 n5 p30, 106-7 (Jul 1978)

1978

Availability: See publication

HS-023 614

### **OPTIMAL CONTROL OF OVERSATURATED INTERSECTIONS: THEORETICAL AND PRACTICAL CONSIDERATIONS**

The development of an optimal traffic signal control policy, minimizing total intersection delay subject to queue length constraints, is approached by first considering the simple case of a single congested intersection. Extension to a system of two or more intersections is not trivial, since travel times between intersections and turning volumes should be taken into account; a solution to this problem is also presented for a simple example. Finally, numerical examples are given to illustrate the applicability and the effectiveness of the theory. The theory can be applied to real-time control systems since the queues at the beginning and ending of the control period can be higher than zero. In such case, the optimal control policy will change frequently as new information concerning the state of the system and predicted demands for the remaining control period arrives. For real-time control, however, development of an adaptive prediction algorithm is necessary. The uncertainty associated with the history of arrivals can also be taken into account by studying the problem with stochastic input. It should be remembered, however, that stochastic optimal control is a new field in control theory; and, due to the complexity of the problem, complete mathematical analysis may not be feasible at this time. The developed theory led to some conclusions that either have been verified in practice or are intuitively apparent. For example, it has been established from experience that traffic-actuated signals result in minimum delay at isolated intersections. Extension of the theory to undersaturated signals showed that the optimal control policy at isolated intersections is identical to that of traffic-actuated signals.

by Panos G. Michalopoulos; George Stephanopoulos

NSF-ENG-77-22827

Publ: Traffic Engineering and Control v19 n5 p216-21 (May 1978)

1978; 21refs

Availability: See publication

HS-023 615

### **THE EFFECT OF TRAFFIC SIGNALS ON ROAD ACCIDENTS--WITH SPECIAL REFERENCE TO THE INTRODUCTION OF A BLINKING GREEN PHASE**

The effect of traffic signalization of intersections on road safety has been evaluated, with special emphasis on the introduction of a 2-second to 3-second blinking green phase at the end of the green period of the traffic signal. It is concluded that the overall safety effect of installing traffic signals is not uniform. At intersections with more than five accidents/year, there is generally a reduction in the number of accidents. At intersections with less than two accidents/year, the number of accidents after signalization generally increases. This result seems to strengthen the general feeling of traffic engineers that traffic signals are not a safety measure as such. They should be considered at locations where they are warranted according to the vehicle volumes. At such locations, they most probably have a beneficial effect on the number of accidents. Signalization does not generally seem to affect the number of pedestrian accidents; for the sample of intersections studied, the proportion of pedestrian accidents remained constant at 23% of the total. Signalization is generally associated with an increase in the proportion of rear-end accidents, and a reduction in the other types of accidents, mainly in right-angle accidents. At the intersections studied, rear-end accidents increased from 7.6% to 20.6% after signalization, and no clear relationship was found between the number of accidents and the total entering flow. This was true for both signalized and nonsignalized intersections. The assumption of a linear relationship between accidents and vehicle flow was therefore not substantiated. At the intersections studied, at which a blinking green phase was added to the traffic signals, the number of accidents increased from 14 accidents per two years per intersection to 19 accidents per two years per intersection. The increase in rear/end accidents when a blinking green phase was installed was greater than the reduction in right-angle accidents which the installation came to prevent, and which it achieved. The resultant weighted severity of accidents did not change significantly before and after the installation.

by A. S. Hakkert; D. Mahalel

Publ: Traffic Engineering and Control v19 n5 p212-5 (May 1978)

1978; 13refs

Availability: See publication

HS-023 616

### **WHY SOME DRIVERS PAY MORE [AUTO INSURANCE]**

The argument of auto insurance companies that it is not unfairly discriminatory to determine insurance rates on the basis of age, sex, and marital status, is strongly bolstered by continuing independent studies of the California Dept. of Motor Vehicles (DMV). These studies, made for reasons other than insurance, demonstrate clearly that different age groups have different accident rates, that the two sexes have different rates, and married people as a group have different accident rates from unmarried people. Discrimination, a basic tenet of insurance, serves both the seller and the buyer, enabling the seller to discover in advance those prospective policybuyers who are least likely to have accidents and charge them the lowest prices. Discrimination among prospective policybuyers also serves those who are more likely to have accidents. A



higher premium price will have to be paid, but insurance is available. The principal findings from the California Fact Book (1976) as they apply to insurance completely corroborate insurance company experience. To a significant degree, members of the group of drivers who have had accidents in the past are likely to have accidents in the future. Moving traffic convictions also are an indicator of future accidents. In using age as a factor in setting auto rates, the insurance companies are considering the youthful drivers; this group has the highest frequency of accidents. The accident rate of female drivers from any age group is always under the accident rate of males for the same age groups. Finally, marital status makes a difference; married males, except for those under 25, consistently have a better record than unmarried males in the average number of accidents per 100 drivers. One important aspect of auto insurance rating systems is the territory assigned to the policybuyer; this has not been studied by the California DMV. Setting the boundaries of a rating territory is easy when done on a broad scale; big cities have more traffic and more accidents, and the costs of medical care and auto repair usually are higher than in small cities. But there are differences within certain areas of large cities which have to be considered.

by Myles Smith

Publ: Journal of Insurance v39 n4 p36-9 (Jul-Aug 1978)  
1978

Availability: See publication

HS-023 617

### **WRECKED. OR HOW TO DRINK SO YOU WON'T PLASTER YOURSELF ALL OVER THE ROAD [ALCOHOL; DRIVING]**

Information on the way alcohol affects the body is presented in an effort to promote wise drinking on the part of the driver. Alcohol, unlike other substances, is not digested in the intestines. It goes directly from the stomach into the bloodstream, which accounts for its quick action on the brain. First, alcohol affects one's thinking; higher levels affect muscle control; still higher levels affect life functions, like breathing. Authorities use the blood alcohol level (BAL), the percentage of alcohol in the bloodstream, to measure one's degree of intoxication. With a BAL between .01 and .05, most people will be pretty near normal, but with some loss of restraint and concentration. Between .05 and .10, judgment is affected, as well as vision. At BAL .10, coordination is affected and the person is legally intoxicated. Some facts about the time it takes to reach such a level of intoxication include the following: the obvious fact that the more one drinks, the drunker one gets; the more one weighs, the more one can drink before becoming intoxicated; if one's stomach is full, food will slow rate at which alcohol is absorbed; if a lot is drunk in a short time, one will get drunk faster; and rate at which body gets rid of alcohol cannot be controlled by the drinker. A general guide on how much an individual (according to weight) can drink in what amount of time is presented in tabular form. Some other facts about drinking, contrary to popular misconceptions, include the following: ability to eliminate alcohol from system not affected by coffee drinking; one's own judgment not always the best measure of ability to drive safely; alcohol, a depressant not a stimulant; ability to get just as drunk with wine or beer as with hard liquor; likelihood of getting a hangover not based on changing drinks but on how much is drunk, no matter what is drunk. Some rules to adhere to if drinking in a social situation include the following: eat

something beforehand, or along with the drinking; drink alcohol slowly, at own pace; set a definite limit on the amount to be consumed, before drinking is started; allow time for the body to rid itself of alcohol, when drinking is stopped; wait a while or have someone else drive you home if you see any signs in yourself that you have had too much to drink; do not drink if your mood is low or you are very tired; and try to convince people who have had too much to drink not to drive.

by Jeri Rood

Publ: Driver v12 n1 p8-13 (Jun 1978)  
1978

Availability: See publication

HS-023 618

### **ALTERNATIVE AUTOMOBILE ENGINES**

The argument that the choice of an alternative to the now-dominant spark-ignition engine is highly complex is presented with a comprehensive review of the advantages and disadvantages of the various candidate engines. These propulsion systems which are most often mentioned as being potentially more promising than the spark-ignition (Otto) engine for meeting or exceeding the Federal requirements in regard to fuel economy and emissions are the compression-ignition (diesel) engine, the steam (Rankine) engine, the gas turbine (Brayton engine), the Stirling engine, and battery electric drives. The kind of government policy believed to be most likely to identify, quickly and economically, the engine or engines (if any exist) that can supplant the conventional spark-ignition engine, is suggested. If the government were to throw its support behind just one or two alternative approaches, the action would be not only unfair but also probably counterproductive because of the inhibiting effect on the alternative engines not supported. The government has the choice of regulating or of taxing. If the government had set easily attainable emission limits and fuel-consumption goals, the costs of regulation would have been acceptable. But this was not the case, and the costs of the alternative approach, taxation (e.g. graduated tax on measured emissions of each make and model of car, energy tax increasing the price of fuel or possibly a comparable energy-thrift tax on each model's measured fuel consumption) would almost certainly have been less. Such a policy would have internalized, in a rough but approximate way, the external costs of pollution and wasteful consumption of petroleum. The logistics of automobile production prohibit the introduction of any new engine on a large scale before the 1990's. Therefore, the optimum way of choosing a future engine(s) is through the modified free market created by taxation, rather than through regulation.

by David Gordon Wilson

Publ: Scientific American v239 n1 p39-49 (Jul 1978)  
1978

Availability: See publication

HS-023 619

### **TIMING CHAIN AND CAMSHAFT SERVICE**

Information and step-by-step procedures (and accompanying illustrations) for servicing timing chains and camshafts are presented for the auto service specialist's use. Directions for servicing are presented in the following sections: valve timing; camshaft end thrust; replacing the timing gears; replacing the

timing chain and sprockets; replacing camshaft bearings; and camshaft servicing.

Publ: Motor v149 n1 PER41-4 (Jan 1978)  
1978  
Availability: See publication

## HS-023 620

**SELLING HIGH PERFORMANCE ENGINE REPAIR**

There are a variety of special high-performance parts and kits available for converting stock engines to high performance at a reasonable cost. If a high-performance enthusiast discovers a worn camshaft, for example, there are high-performance cams available as replacements that will provide a fairly even blend of good low-, medium-, and high-speed performance. Others will give greater top-end power, but the engine cannot be idled below 1000 rpm. Still other camshaft designs will produce strong mid-range and top-end torque but at the cost of weak low-end power delivery and a rough idle. A stock camshaft design usually gives minimal top-end performance but good low-end and mid-range performance, along with a smooth idle. The auto service specialist should discuss with the customer the various types of camshafts available and the trade-offs involved, before a camshaft is selected. When a high-performance camshaft is installed, the time is ideal to discuss installation of a high-performance balanced timing chain and sprocket kit. Also, new tappets should be installed to avoid damage to the cam as a result of old wear patterns in the tappets. Here again, installing new tappets is a good opportunity to install either a better quality conventional hydraulic tappet or special antipump-up tappets or mechanical (fixed) tappets. The antipump-up tappet is specially designed to limit plunger travel, so it allows greater engine rpm. New rocker arms, valve springs, and pushrods must also be installed to go along with the other high-performance equipment. Where the initial problem is burnt valves or leaking valve guides, the high-performance enthusiast has the opportunity for the service specialist to install special high-performance valves along with new valve guides. In the area of engine bearings, there are street-type bearings available for the high-performance buff; competition-type bearings should only be used by the serious racing driver. The more serious high-performance car owner will want to consider a change to a high-performance piston ring made to withstand extra loads. Since the goal of high performance is more power, increasing the compression ratio by installing high-performance pistons, requiring a special camshaft, is very common.

Publ: Motor v149 n1 PER72-5 (Jan 1978)  
1978  
Availability: See publication

## HS-023 621

**REFLECTORIZATION FOR NIGHTTIME CONSPICUITY OF BICYCLES AND MOTORCYCLES**

Two studies were conducted to test the relative effectiveness of prismatic retroreflectors and retroreflective sidewall tires in increasing the nighttime conspicuity of bicycles and motorcycles. The primary emphasis in these studies was on increasing the conspicuity of the two-wheeled vehicles when viewed from the side, rather than from the front or rear. The scope of the studies was restricted to simulated intersection conflicts in which the motorist must detect a bicycle or motorcycle

crossing in his/her path. It was found that pure detection distances are primarily dependent upon the absolute luminance values of the stimulus objects (reflectors or tires). Reflective sidewall tires, however, were highly superior to prismatic reflectors in aiding recognition of a bicycle or motorcycle in a simulated rural intersection with common nighttime visual clutter, and also were of greater value in identifying the direction of movement of these vehicles. The findings suggest that standard amber and red reflectors on bicycles and motorcycles are inadequate to provide an oncoming motorist with a safe stopping distance, and that shape cues can greatly enhance luminance in providing adequate advance detection and recognition.

by Albert Burg; Jinx Beers

Publ: Journal of Safety Research v10 n2 p69-77 (Summer 1978); 4refs  
Sponsored in part by the 3M Co.  
Availability: See publication

## HS-023 622

**PISTONS, PINS AND ROD SERVICE**

Information and step-by-step procedures (and accompanying illustrations) for servicing pistons, pins, and rods are presented for the auto service specialist's use. Directions for service are presented in the following sections: external oil leak preliminary examination (exterior checks, compression checks, examining the rings, overlapping of oil ring expanders, proper size rings, scuffing of the ring faces, ring breakage, rings installed upside down, rings scratched from rough bore finish, cylinder bore examination, break-in); disassembling engine for a ring job (removing the pistons and rods, removing the piston rings, replacing the piston rings); piston (piston problems (piston burning, piston land breakage, piston scuffing and scoring), importance of pin fitting, piston pin lock failure); checking cylinder bores (measuring cylinder bore taper, bores that are out of round, instruments for measuring the cylinder bore (dial gauge method, inside micrometer method, telescope gauge and outside micrometer method) and proper honing. Included are a honing checklist, an outline of the causes of ring scuffing, and an outline of common causes of ring breakage.

Publ: Motor v149 n1 PER46-54 (Jan 1978)  
1978  
Availability: See publication

## HS-023 623

**HOW TO TAKE AND PASS THE NIASE CERTIFICATION TESTS [NATIONAL INSTITUTE FOR AUTOMOTIVE SERVICE EXCELLENCE]**

The certification test of the National Inst. for Automotive Service Excellence is of value in establishing universal standards and credentials, recognizing experienced mechanics, creating public confidence in the auto repair field, and helping certify mechanics to get a job. The test covers basic technical knowledge, with questions designed to separate untrained mechanics from those with practical experience. Advice is offered on the right attitude towards the test: neither nervousness nor overconfidence; persistence; the advantages of studying with others and pooling knowledge; keeping track of time during the test; leaving no questions unanswered. For sample questions are provided, geared to teaching, a

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spanning many car model years; questions on recent developments, such as diagnostic connectors, electronic spark controls, emission controls and diesel engines, as well as on older cars and procedures. The questions are reprinted from Auto Engines and Electrical Systems, Professional Service Trade Edition, by Motor Publications; answers may be obtained by writing to Sample Questions at the magazine.

Publ: Motor v149 n1 PER76-81 (Jan 1978)  
1978

Availability: See publication

HS-023 624

### FRONT-WHEEL-DRIVE REVOLUTION: IT'S HERE

The trend toward front-wheel drive (fwd) in Europe, Japan, and the U.S., constitutes a revolution in auto design. With the engine and entire drivetrain in the front of the vehicle, more useable space is obtained in relation to outside dimensions and to weight. Early fwd layouts used by Citroen and Cord in the 1930's positioned the engine behind the front wheels and saved no interior space; in the 1960's, General Motors' Oldsmobile placed the engine above the front wheels, with a fluid torque converter on the back and a chain to transfer the drive to a gearbox and differential placed alongside the crankcase on the left. This arrangement, though practical, was still not as compact as needed for modern compact cars. The present "classic" fwd layout was pioneered by Alec Issigonis of British Motor Co. (BMC) in the Austin Mini, with a small four-cylinder engine crosswise above the front wheels; present versions position the engine crosswise ahead of the wheel centers, allowing the passenger compartment to be pushed forward. Instead of chain drives, most of the small fwd cars use a pair of helical gears to transfer the drive from the clutch to the transmission input shaft; a set of gears is much cheaper than chain and sprockets. Incorporating an automatic transmission in the drivetrain presents an engineering problem of miniaturization, successfully achieved by Honda, BMC, and Renault. Constant velocity U-joints have been developed which, though relatively expensive, are compact, have minimum friction, and can be lubricated for life with modern seals. With fwd, having the steering axis fall a little outboard of the center of the tire (negative scrub radius) seems to work better than the positive, with less wheel fight on rough roads, smoother steering at high speeds, and less effect on steering feel by hard braking. Servicing these new drivetrains should not be harder in spite of their differences; accessibility of the drive components is good and the separation of the engine and drivetrain into more or less discrete components should simplify procedures. The all-indirect type of manual transmission has been in use in many rear-drive cars for some time. Though modern constant velocity joints are complicated, they will probably be serviced as an assembly, and replaced as a whole unit. Photographs and diagrams illustrate various developments.

by Roger Huntington  
Publ: Motor v149 n1 p41-3, 56 (Jan 1978)  
1978

Availability: See publication

HS-023 625

### CRANKSHAFT SERVICE

Oil leakage is indicated by low oil pressures and/or excessive bearing clearances. A bearing leak detector provides the only precise method of checking. Conditions that cause a knocking rod bearing or main bearing are listed; rod bearing knocks require replacement of the upper and lower halves of the bearing. A rod bearing check should always be part of a ring job. Inspection of the crankshaft journals is essential, with regrinding if necessary. The main bearing journals can be checked with the crankshaft either in or out of the engine; if outside, either with an outside micrometer or a V-block gauge. Three ways are explained of checking rod and main bearing clearances: the shim method, plastigage method, and micrometer method. Installation of rod and main bearings is described, as well as checking after installation and Oil seal replacement. The major service operations requiring crankshaft removal are usually best performed with the engine out of the car. On cars with manual transmission, the surface of the flywheel should be carefully examined for scoring, cracks or burned areas, and replaced if more than a slight amount of metal has to be removed to correct the problem. The clutch shaft pilot bearings should also be checked for wear. Flywheel runout should be checked with a dial indicator mounted on the flywheel and causes corrected; the flywheel ring gear should be replaced if the teeth are broken or worn.

Publ: Motor v149 n1 PER56-62 (Jan 1978)  
1978

Availability: See publication

HS-023 626

### COURT SYSTEMS FOR DRINKING DRIVERS

The misdemeanor courts charged with enforcing DUI (driving while under the influence) laws have long been plagued with backlogs and delays, as well as a tendency toward leniency in dealing with DUI offenders; as a result, administrative adjudication by the licensing or other agency has become increasingly popular. This situation existed when the Alcohol Safety Action Prog. (ASAP), started in 1970 by the National Hwy. Traffic Safety Administration (NHTSA), began working with the misdemeanor courts in 35 states. ASAP worked at integrating the misdemeanor courts in the ASAP system. ASAP-developed court systems are characterized by a tendency to minimize trials and to use the threat of sanctions to coerce attendance at treatment agencies. Under ASAP, the courts have begun to cooperate extensively with other agencies in dealing with DUI offenders and have frequently become leaders in the system. Although ASAP has not yet demonstrated effectiveness at reducing alcohol-related crashes and fatalities, it has had a significant positive impact on the court system.

by Gary J. Scrimgeour  
Publ: Journal of Safety Research v10 n2 p50-7 (Summer 1978)  
1978; 14refs  
Availability: See publication

HS-023 627

### COOLING SYSTEM SERVICE

Information and step-by-step procedures (and accompanying illustrations) for servicing an engine's cooling system are presented for the auto service specialist's use. Directions for

servicing are presented in the following sections: flushing the cooling system (simple flush, flushing tee, moderate reverse flush); water pump service; and variable speed fans. None of the flushing procedures requires removal of the engine block drain plugs. When servicing the water pump, it is important to check other components of the fan-pump system to make sure they are not causing any harm to the water-pump shaft.

Publ: Motor v149 n1 pER68-71 (Jan 1978)

1978

Availability: See publication

## HS-023 629

### **RUNFLAT STABILIZER [TIRES]**

A C-shaped fiberglass reinforced plastic runflat stabilizer has been developed that can be mounted around the wheel well inside an inflated tire. The stabilizer, along with its lubrication system, allows the driver to operate the vehicle despite zero air pressure in a flat tire. This eliminates the need for a spare tire, saves trunk space, reduces weight, and, most important, does away with the inconvenience and danger of roadside tire changing. The stabilizer is designed so that it can be used with standard radial tires and standard single-piece drop-center wheels. Thus, the normal excellent inflated performance of the tire can be realized while the passive stabilizer is inside. Un-repairable tire failures that require a new tire present no problems in locating a new tire because a standard radial tire can be used.

by L. Seelbach Kraft; G. Timothy Watts

Goodyear Tire and Rubber Co.

Rept. No. SAE-770350; 1977; 8p 1ref

Presented at International Automotive Engineering Congress and Exposition, Detroit, 28 Feb-4 Mar 1977.

Availability: SAE

## HS-023 630

### **METRICATION OF A MANUFACTURING FACILITY [CHEVROLET FLINT ENGINE PLANT]**

With the decision in 1974 to build a U.S. version of the Chevette, various Chevrolet manufacturing facilities launched extensive metric conversion programs; at the Flint Engine Plant, committees were established to solve metric-related problems and to educate employees. Various manufacturing and engineering standards were reviewed and rewritten to incorporate metric-related dimensioning. Production parts, tools, and machines were identified for segregation with English parts. Specific information is given concerning such identification techniques for screw threads as color coding, special markings, and different physical dimensions. As a result of education, problem investigation, and organized implementation, the conversion to the metric system at this manufacturing plant has been smooth. Further educational requirements will be met by scheduling new employees for metric training. The plant metric committee continues to evaluate problems as they arise.

by David F. Vernon

Chevrolet Flint Engine Plant

Rept. No. SAE-770357; 1977; 6p

Presented at International Automotive Engineering Congress and Exposition, Detroit, 28 Feb-4 Mar 1977.

Availability: SAE

## HS-023 631

### **METRIC IMPACT ON ENGINEERING DESIGN AND MANUFACTURING**

Impact of the metric system's use in engineering design is discussed for format, rounding off, tolerancing, drafting equipment, and design and development. Effects on engineering mathematics are specified for charting, tabulations, and nomograms; also considered are the effects of conversion to metric on machines, dials, and tools (particularly checking and gaging tools). Dual dimensioning (i.e. including within the drawing both the metric unit and its customary equivalent) is good only during the transition period to metric; a metric-dimensioned drawing should be the ultimate goal. The opportunity provided by the advent of metrication should best be used to produce by way of experimentation and research, new charts, tabulations, and nomograms instead of just converting from the customary to the metric system. The use of a computer for conversion is cost-justified only in large-scale operations. In the machine shop area, accuracy, availability, economy, and flexibility are the criteria that decide the use of replacement dials. Also, the problem of hard conversion (i.e. changes in dimensions, and tolerances, of various products) needs careful attention in machine shop metrication. Impact on inventory, storage, and handling should be thoroughly studied while drawing the plans for metrication in manufacturing. The labor demands for personal metric tools and training for shop employees certainly deserve attention in any manufacturing environment.

by Mohan N. Joshi

Wolf Detroit Envelope Co.

Rept. No. SAE-770358; 1977; 12p 6refs

Presented at International Automotive Engineering Congress and Exposition, Detroit, 28 Feb-4 Mar 1977.

Availability: SAE

## HS-023 632

### **HEAT AND MIXTURE CONTROL FOR GASOLINE ENGINES**

The power from a gasoline engine can be controlled by a simultaneous change of inlet temperature and air/fuel ratio (A/F). The power is reduced by heating of the air/fuel mixture and reduction of A/F so that the mixture becomes more lean. Experiments with a CFR (Cooperative Fuel Research) engine have shown that the power can be controlled in this way from idle to full load. Later experiments on an automobile engine confirm that the control method is applicable to standard gasoline engines. By the use of mixture and heat control, an improvement in efficiency under part load conditions is obtained, mainly the result of pumping losses becoming small. The control method is favorable for low air pollution effects since an equivalence ratio greater than 1.3 can be used over the largest part of the power range. This results in relatively small emissions of carbon monoxide, hydrocarbon, and nitrogen oxides. With respect to efficiency and low emissions, mixture and heat control can be regarded as an alternative to stratified-charge combustion in gasoline engines. Due to higher inlet temperature, knocking tendencies are greater than in an engine with throttle control, but results show that knocking can be controlled by adjustment of the ignition timing. Exhaust valves were exposed to higher temperatures over a larger part of the power range than with throttle control, so

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that the temperature over most of the loading range was up to the same level as at full load.

by Erik Kofoed; Flemming P. Greenfort  
Technical Univ. of Denmark, Dept. of Mechanical  
Engineering, Denmark; Elsinore Shipbuilding Co., Denmark  
Rept. No. SAE-770354; 1977; 8p 11refs  
Presented at International Automotive Engineering Congress  
and Exposition, Detroit, 28 Feb-4 Mar 1977.  
Availability: SAE

HS-023 633

### **A FEEDBACK CONTROLLED CARBURETION SYSTEM USING AIR BLEEDS**

A feedback-controlled carburetion system has been developed that maintains a flow of exhaust gases of uniform composition. This is a requirement if three-way or dual-bed catalytic converters are to be used in meeting projected emission standards. Exhaust gas uniformity depends upon delivery of a constant air/fuel ratio (A/F) by the carburetor. Instead of metering fuel directly, precise and responsive control of the A/F is obtained by using variable air bleeds in the carburetor fuel circuits. The air bleed control can be integrated with present carburetors with minor hardware modifications. The system is insensitive to transient A/F changes indicated by the oxygen sensor. The system can be tailored to various types of catalytic converters and vehicle combinations. Finally, the feedback carburetion system provides a more constant A/F than is presently obtainable with carburetors alone by compensating for internal and external effects.

by T. R. Gantzert; D. L. Hicks; M. A. Jefferis  
ACF Industries, Inc., Carter Carburetor Div.  
Rept. No. SAE-770352; 1977; 11p 5refs  
Presented at International Automotive Engineering Congress  
and Exposition, Detroit, 28 Feb-4 Mar 1977.  
Availability: SAE

HS-023 634

### **EMISSIONS AND FUEL ECONOMY INTERACTION**

Data from dynamometer tests are presented which show the fuel consumption penalty when emission requirements constrain air/fuel ratio (A/F) to near stoichiometric mixtures. A 260 cubic inch displacement (CID) V-8 engine was utilized in the tests. The A/F constraint imposed by a three-way catalyst system results in an engine efficiency loss which must be weighted against the lower nitrogen oxides (NOx) values achieved with three-way catalysis. With present systems, better fuel economy can be achieved with air as the diluent at the same driveability level. At this driveability level, engine NOx emissions appear to be equivalent and hydrocarbons (HC) are slightly higher with the lean system. Understanding of the fundamental interactions among driveability, emissions, fuel economy, and thermodynamics is essential in developing systems which meet the required fuel economy and emission constraints while providing customer satisfaction.

by Roy C. Nicholson  
General Motors Engineering Staff, Advance Product  
Engineering  
Rept. No. SAE-780616; 1978; 7p 11refs  
Technical Paper Series. Presented at Passenger Car Meeting,  
Troy, Mich., 5-9 Jun 1978.  
Availability: SAE

HS-023 635

### **ELECTRONICALLY CONTROLLED ENGINE SPEED GOVERNING [GOVERNOR]**

The development and evaluation of an electronically controlled engine speed governor for use on gasoline engine Chevrolet and GMC medium-duty and heavy-duty trucks are described. When the introduction of a new electronic High Energy Ignition System on Chevrolet and GMC trucks made obsolete the spinner-type ignition distributor, which incorporated the flyweight control valve for the former governor, a need for a new governor mechanism was made evident. The growing demand for dependable commercial vehicles suggested that a new governor system with increased durability and improved driveability should be developed. Total vehicle and governor component inputs to the engine were analyzed and an electronically controlled governor vacuum system was developed utilizing existing, recalibrated carburetor control parts. Evaluations were totally in-vehicle to analyze results from the operator's point of view. Definitions and performance bogeys were established as the system was developed. The electronic controller monitors engine speed and operates a solenoid valve producing a tailored vacuum signal that controls throttle opening. The new governor system was evaluated with new and exacting definitions of spread, surge, overshoot, full-load speed, and reload. The electronic governor system shows driveability improvements over the old spinner system at slightly lower cost and improved durability. It also represents an industry "first" in the application of electronics to gasoline engine governors. Test procedures 1003 and 8633 are presented in appendices.

by W. L. Humbert; R. G. Kibler  
General Motors Corp.  
Rept. No. SAE-770356; 1977; 18p 3refs  
Presented at International Automotive Engineering Congress  
and Exposition, Detroit, 28 Feb-4 Mar 1977.  
Availability: SAE

HS-023 636

### **THE EFFECT OF FUEL HYDROCARBON COMPOSITION ON EXHAUST EMISSIONS FROM JAPANESE VEHICLES**

The effect of fuel hydrocarbon (HC) composition on exhaust emissions was determined according to the Japanese statutory cycles for five Japanese vehicles using seven kinds of unleaded fuel. Vehicles used for the tests were conventional internal combustion engine vehicles with, and without, oxidation catalyst and EGR (exhaust gas recirculation); rotary engine vehicles with, and without, thermal reactor; and a CVCC engine vehicle. HC composition of the seven fuels varied from 10 vol.% to 50 vol.% in aromatics and from 0 vol.% to 25 vol.% in olefin content. The effect of fuel composition on mass emissions of carbon monoxide (CO), HC, and nitrogen oxides (NOx) was found to be of little significance for any of the vehicles tested. The HC composition in exhaust gas varied substantially with the fuel composition and emission control system of the vehicles. As the fuel aromatics increased, aromatic content in the exhaust HC fraction also increased, but olefin content tended to decrease in all vehicles except the catalyst vehicle. The specific reactivity of the exhaust HC fraction did not vary much for any vehicle except the catalyst one, even if the fuel HC composition varied. The catalyst vehicle showed lower aromatic and olefin contents in exhaust and consequently, lower reactivity, especially on the ten-mode

hot cycle, than the other vehicles. A good relationship between olefin and aldehyde contents in exhaust organics was observed in all data obtained from this program.

by K. Hosaka; T. Onodera; Eric E. Wigg  
Toa Nenryo Kogyo K.K.; Exxon Res. and Engineering Co.  
Rept. No. SAE-780625; 1978; 15p 7refs  
Technical Paper Series. Presented at Passenger Car Meeting,  
Troy, Mich., 5-9 Jun 1978.  
Availability: SAE

HS-023 637

### **DEVELOPMENT OF THE CALSPAN/CHRYSLER RESEARCH SAFETY VEHICLE (RSV)**

The Calspan/Chrysler Research Safety Vehicle (RSV) program, sponsored by the National Hwy. Traffic Safety Administration (NHTSA), is a four-phase effort to develop a lightweight, advanced safety vehicle design suitable for family transportation in the 1985 time period. The vehicle design is intended to be compatible with current production techniques, and to be fuel-efficient, nonpolluting, recyclable, and affordable. It is intended to provide adequate safety and protection for its occupants, pedestrians, and occupants of other cars (non-aggressivity) to ensure that the overall cost of personal transportation is minimized. During Phase 1 (Jan 1974 through Apr 1975) and Phase 2 (Jul 1975 through the end of 1976) of the program, vehicle specifications were established and design concepts evaluated via computer simulations and full-scale testing. The program is currently in the third phase of activity, which was initiated in Jan 1977 and will run through Dec 1978; this phase deals with the optimization of the design of the various subsystems and their cumulative integration into a final coordinated vehicle design. Specifically considered are the following aspects of RSV development: aerodynamics, emissions, air conditioning, suspension, antiskid brakes, run-flat tires, manufacturability, soft bumpers, plastic headlamps, high rear lamps, vehicle pitch and balancing, headroom, interior design, air bags and inflatable seat belts, and driver controls. This effort is being supported by developmental tests and mathematical modeling to demonstrate the resulting performance that can be expected of the overall design. Phase 3 culminates in the fabrication of ten vehicles that will be utilized in Phase 4 to further validate the RSV performance achieved with regard to the initial goals. It is believed that the RSV is a producible, safe family automobile that includes many characteristics that will be produced in the 1985 era; as such, it can provide NHTSA with the desired data for background in their rulemaking activity.

by Gardner J. Fabian; Saverio M. Pugliese; Alexander J. Szilagyi  
Calspan Corp., Advanced Technology Center; Chrysler Corp.  
Rept. No. SAE-780602; 1978; 28p  
Technical Paper Series. Presented at Passenger Car Meeting,  
Troy, Mich., 5-9 Jun 1978.  
Availability: SAE

HS-023 638

### **DESIGN OF A PLASMA JET IGNITION SYSTEM FOR AUTOMOTIVE APPLICATION**

The development of a plasma jet ignition (PJI) system based on the use of plasma jet spark plugs is described. Particular attention is given to systems design for automotive application. Design data for plasma jet spark plugs are given. Tests on a

37.3 CID (cubic-inch displacement) single-cylinder engine with vapor tank fuel metering indicate that PJI produces extension of the lean misfire limit, reduction of ignition delay and burn time, higher nitrogen oxide (NO), and increased torque compared to conventional ignition. Operating experience for a four-cylinder 2.3L test vehicle is also described, including CVS-H (constant volume sampler) and steady-state tests. PJI did not exhibit marked improvement in vehicle performance or emissions in these tests, although the engine had not been calibrated for PJI. Discussion of the electrical power requirements of a PJI system is also presented. The test data do not indicate any overwhelming advantages for PJI; however, it must be recognized that these data are preliminary and rather limited in scope. Because of such favorable characteristics of the system as ignition source turbulence and electrodeless ignition, it would appear highly desirable to carry out further tests on PJI capabilities.

by J. R. Asik; P. Piatkowski; M. J. Foucher; W. G. Rado  
Ford Motor Co.  
Rept. No. SAE-770355; 1977; 18p 19refs  
Presented at International Automotive Engineering Congress  
and Exposition, Detroit, 28 Feb-4 Mar 1977.  
Availability: SAE

HS-023 639

### **THE 'MEXICAN CONNECTION.' AUTO THEFT RACKET CRIPPLED**

A recent accomplishment of the California Hwy. Patrol (CHP) in discovering an auto theft ring which was involved in running vehicles stolen in California (and Texas, Tennessee, and New Mexico) across the border for sale in Mexico is reported, along with other activities in the CHP's war on auto thievery. Evidence found by the CHP officers involved in the Mexican investigation which began in Nov 1977, and CHP conferences with Mexican officials virtually crippled one ring, but other rings are still operating. However, under a new cooperative plan being worked out, persons trying to sell vehicles in Mexico that have been stolen in the U.S. are going to have a more difficult time. The would-be sellers will be photographed and their thumbprints taken for identification. Other parts of the antitheft program now being devised through cooperation of Mexican and California officials, call for an exchange of information on vehicle registrations, especially on those reported stolen. One of the major problems in the past has been that only a handwritten bill of sale was required in Mexico to show ownership. The success of this five-month investigation in Mexico was one of the crowning achievements of the CHP's massive attack on auto thievery, which was initiated in 1973, when the CHP was awarded a \$1.25-million Federal crime grant to coordinate a one-year program with other law enforcement agencies in combating the auto theft racket. At that time, more than 140,000 vehicles were being stolen annually in California, costing the state about \$100 million a year. Since that time, the CHP has focused on developing a closer cooperation with city police departments and sheriff's offices, and the state has also increased its funding of the attack on motor vehicle thievery. Measures taken include the formation of a statewide vehicle theft advisory committee, the development of improved titling and licensing procedures within the DMV (Dept. of Motor Vehicles), improvement in the state's computerized system for supplying up-to-date information on stolen vehicles to law officers throughout the state, and the training by the CHP of officers in the handling of auto theft investigations. The public and car owners can materially

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help this antitheft effort by following protective tips, the first being always to lock your car and take the key with you, locking your car in your garage at night.

by William L. Roper  
Publ: California Highway Patrolman v42 n5 p6-7, 34-5, 38-40, 43, 45 (Jul 1978)  
1978  
Availability: See publication

HS-023 640

**FACILITIES FOR CYCLISTS AND MOPED RIDERS. RESULTS OF THE 1975-1 ANWB SURVEY (VOORZIENINGEN VOOR FIETTERS EN BROMFIETTERS. RESULTATEN VAN DE ANWB-ENQUETE 1975-1)**

The Traffic Dept. of the Royal Dutch Touring Club, ANWB, has made an investigation into the presence and planning of provisions for bicyclists and moped riders in Dutch municipalities. Results are presented for 538 municipalities with a total of 10.7 million inhabitants (81% of municipalities responding to survey). The results were classified into seven groups representing different population sizes (from 0-5000 inhabitants to 500,000 or more inhabitants). The types of facilities surveyed include the following: adjacent bicycle (moped) paths; isolated bicycle (moped) paths; cycle lanes; special routes; one-way traffic with exemptions; intersections of cycle (moped) paths or special routes and road intended for motor vehicles; intersections of cycle (moped) paths or special routes and railroad, streetcar, or metro lines; intersections of cycle (moped) paths or special routes and rivers or other bodies of water; public parking facilities (for a minimum of 20) bicycles (mopeds); and bicycle route plans or bicycle path plans. Questionnaires which were returned revealed that the facilities in question were absent from only 27 communities, representing about 5% of the total. It may be fairly concluded that over the years much has already been done in The Netherlands for the cyclist. The results also show that many facilities have been planned for the future. Facilities should be provided on an even larger scale.

Publ: Verkeerskunde n6 p286-95 (1975)  
1975; 39p  
Translated from Dutch (original text 10p; 0 translation 29p).  
Availability: Reference copy only

HS-023 641

**METRIC FASTENER OVERVIEW [ENGINEERING STANDARDS FOR INDUSTRIAL FASTENERS]**

The rationale for going metric in North America is explained by describing activities of an ANSI (American National Standards Institute)-sponsored special study to develop an Optimum Metric Fastener System (OMFS) and the results to date. The following topics are discussed: fastener significance; diameter/pitch recommendations; thread forms; thread gauging; bolt head design; materials; metric identification; nut design; small screws; rivets; clearance holes; pipe threads; inspection and quality assurance; availability and selection; and potential value of a planned, coordinated changeover to using metric standards. Ford Motor Co.'s fastener simplification

model is presented as an illustration of the value of a coordinated approach to metrication.

by S. E. Mallen  
Ford Motor Co.  
Rept. No. SAE-770359; 1977; 22p  
Presented at International Automotive Engineering Congress and Exposition, Detroit, 28 Feb-4 Mar 1977.  
Availability: SAE

HS-023 642

**VEHICLE INSPECTION HANDBOOK. PASSENGER CARS. 1978 ED.**

Succinct descriptions of inspection procedures and objective statements of the grounds for rejecting passenger cars and station wagons are presented which are responsive to motor vehicle inspection requirements and to changes in vehicle design significant to motor vehicle inspection programs. This edition interprets the American National Standards Institute's (ANSI) American National Standard Inspection Procedures for Motor Vehicles, Trailers, and Semitrailers Operated on Public Highways, ANSI Standard D7.1-1973. Also reflected are the National Hwy. Traffic Safety Administration's (NHTSA) Vehicle-In-Use Inspection Standards (Title 49 CFR Part 570), and its amendments enacted, through those of Docket No. 73-9. This handbook is intended as a guide for both the individual inspector and for the person responsible for planning and implementing a meaningful inspection program based on sound engineering principles. Information is presented in the following sections: registration, brakes, tires and wheels, suspension and steering, lighting and electrical, vehicle glazing, body and sheet, exhaust and fuel systems, and vehicle emission control systems.

Motor Vehicle Manufacturers Assoc. of the United States, Inc., Engineering Div., 300 New Center Bldg., Detroit, Mich. 48202  
1978; 42p  
Prepared in cooperation with American Assoc. of Motor Vehicle Administrators.  
Availability: Corporate author

HS-023 643

**SIMULATION IN DRIVER TRAINING**

A review of the literature relating to the use of simulators in driver training is presented. The types of driving simulators produced are discussed in detail to show the range of training devices available. On the basis of an assessment of the research already conducted, widespread use of open-loop simulators in driver training programs is not supported. However, the evaluations conducted on controlled driving tracks to date do not permit a judgment of their efficacy to be made. There is a significant requirement for programmatic research on the proper use of simulation in driver training. Although some limited experimental data are available which may support the use of simulation in driver training, no clear-cut conclusions can be stated. Furthermore, in large-scale field evaluation, simulators fared less well in general than other training methods, but cost significantly more per completed student. There is no good evidence to support their adoption at this time. Many of the past efforts in driver training have been devoted to the development of various training devices, but few of these devices have been evaluated in a systematic way.



and an analytical model of the functional requirements of various training devices provide the necessary prerequisites for the initiation of systematic driver training research. This research should be oriented toward an optimized driver training program in which the value of various driver simulation devices, including closed driving circuits, is evaluated in terms of their effectiveness in the training, transfer, and retention of driver skills within an efficient driver training curriculum.

by R. C. Williges; T. J. Triggs  
Monash Univ., Human Factors Group, Clayton, Vic. 3168, Australia  
Rept. No. HFR-6; 1977; 53p 87refs  
Sponsored by Australian Commonwealth Dept. of Transport.  
Availability: Corporate author

HS-023 644

### THE OPERATION OF DRIVER LICENSE DISQUALIFICATION AS A SANCTION

In the first Australian research on the operation of driver license disqualification as a sanction, a mail survey was conducted of 4492 drivers disqualified in Victoria during the period 1 Oct to 31 Dec 1975. Female offenders, out-of-state drivers, and offenders disqualified for less than 48 hours were excluded from the study. The respondent sample of 1552 subjects represented a response rate of 37.2%. Results showed that 36.4% of the respondents admitted driving while disqualified, with over 40% of these subjects driving on more than 20 occasions. The most common reasons for driving were "exceptional circumstances," employment-related circumstances, or whenever transport needed. The person who drove while disqualified tended to be under 40 or over 60 years of age; unmarried or separated; employed as an unskilled worker, skilled tradesperson, member of the armed services, professional driver, or a student, or unemployed; disqualified two or more times previously; and convicted of less serious offenses. The highest frequency of violations were reported by subjects disqualified for a period of one to two months. Only 15.4% of the sample was able correctly to identify the penalty for driving while disqualified, although knowledge of this penalty was not significantly related to whether or not subjects drove. Approximately half of those who drove while disqualified claimed that they drove more carefully than when they were licensed. However, subjects' attitudes toward disqualification were equivocal, with no clear consensus on whether the sanction had a deterrent effect, and with most subjects doubting that the sanction produced any driver improvement. Subjects who did not drive while disqualified still relied on the private motor vehicle as their major means of transport for employment, shopping, and social occasions. If the sanction continues to be used as it is at present, new measures should be introduced to increase offenders' expectancies of apprehension; random license checks have been suggested as one such measure. Offenders should be more clearly warned at the time of their disqualification of the penalties involved for driving while disqualified. Changes in the use of the sanction are recommended: disqualification should be imposed only for relatively serious offenses, and it should not be repeatedly imposed on persistent traffic offenders. Consideration should be given to the establishment of a driver improvement program for traffic

offenders, with disqualification being used as a higher order penalty within such a program.

by Christopher D. Robinson  
University of Melbourne, Dept. of Criminology, Vic., Australia  
1977; 142p 47refs  
Sponsored by Australian Commonwealth Dept. of Transport  
Availability: Mr. Mike Davis, Road Safety Information Service, G.P.O., Box 1839Q, Melbourne, 3001, Australia

HS-023 645

### TRAFFIC ACCIDENT FACTS 1977. AN ILLUSTRATED ANALYSIS OF ACCIDENT RECORD [STATE OF FLORIDA]

Statistics on traffic accidents occurring in the State of Florida during 1977 are presented in graphical and tabular form. In summary, there were 284,965 traffic accidents involving 517,113 drivers. There were 162,162 persons killed or injured in 103,380 accidents; 1852 fatal accidents claimed the lives of 2066 persons. Three percent of all persons injured and 24% of all persons killed in traffic accidents were pedestrians. The 1977 mileage death rate of 3.1 deaths per 100 million vehicle miles of travel remained the same as 1976. Nineteen percent of all pedestrians killed were not crossing at the intersection of the crosswalk. Males accounted for 68% of all persons killed. 64% of all drivers in accidents were male and 76% of all drivers in fatal accidents were male. Fatalities increased 3% from 1976 to 1977 and accidents increased 5%. Sixty-five percent of all accidents occurred in urban areas, but 59% of all traffic deaths occurred in rural areas. The ratio of injured to killed was 77 to 1. Eighty-seven percent of all motor vehicles involved in accidents were equipped with seat belts; however, only 17% of those vehicles had seat belts in use at the time of the accident. Of the 1126 persons killed who had seat belts available, only 5% were using them.

Florida Hwy. Patrol, Accident Records Section  
1978; 33p  
Availability: Corporate author

HS-023 646

### THE SHORT-TERM EFFECTIVENESS OF WRITTEN DRIVER KNOWLEDGE TESTS

A study of the efficacy of knowledge testing of drivers as a accident/conviction reduction countermeasure was conducted. Hwy. Safety Prog. Standard 5, Driver Licensing, issued by the Dept. of Transportation (DOT) requires the states to test applicants for a renewal of their operator's license on rules of the road at least once every four years. The State of Virginia requested a waiver of the testing portion of the standard until evidence could be presented to show that knowledge testing has the desired safety benefit. The waiver was granted and was predicted on an agreement that the state would conduct the present study. Four groups of drivers were tested as follows: a control group receiving no treatment, a group that received only a driver's manual, a group that received a manual and a test to be completed at home, and a group that received a manual and were requested to take a test in the examining station at the time of application for license renewal. Comparisons among groups were made of accidents, major convictions, minor convictions, accidents with an associated conviction, and administrative actions taken as a result of



points accumulated under the Driver Improvement Program. For the two groups given a knowledge test, comparisons involved those who passed, failed, or refused to take the test. (Since Virginia statutes do not require knowledge testing for every renewal applicant, there was the probability of a refusal group). This study covers the first six months of driving exposure for each applicant; a second report will be prepared at the end of two years of driving exposure. Of 135 comparisons carried out, there were no statistical differences which reached significance in 125 of them. Of the ten comparisons in which a statistical difference was found, seven involved applicants who refused to take the home test. In each case, their driving records were worse than the records of those in the group to which they were compared. These findings for applicants refusing to take the home test do not provide state licensing officials with meaningful data for the implementation of a knowledge retesting program. In addition, two of the other three comparisons where a significant difference was found involve accident with conviction data where the sample size is very small and thus limits the practical effects of the statistical results. Because of the number and nature of the categories that were different, it is concluded that knowledge testing does not improve short-term driving performances as measured in terms of accidents, convictions, and administrative actions.

by C. B. Stoke

Virginia Hwy. and Transportation Res. Council, Box 3817  
University Station, Charlottesville, Va. 22903  
Rept. No. VHTRC-78-R51; 1978; 55p 6refs  
Sponsored by Highway Safety Div. of Virginia. Prepared in cooperation with Virginia Div. of Motor Vehicles.  
Availability: Corporate author

HS-023 647

### **SPEED CONTROL HUMPS IN CUDDESDON WAY, COWLEY, OXFORD**

Speed control bumps designed at the Transport and Road Res. Lab. have had a one-year trial on a public road (Cuddesdon Way, Cowley, Oxford, England), the first of a small number of sites where trials are being conducted. Cuddesdon Way has an accident history of 24 injury accidents involving 28 casualties in the three years and ten months before the bumps were installed. Eleven of those sustaining injuries were child pedestrians; two were child cyclists; one was an adult pedestrian; the remainder were vehicle drivers or passengers. This casualty frequency is high for a residential road less than 800 m long. A major problem is that this road can be used as a shortcut by vehicles leaving the British Leyland Cowley works to join the Oxford ring road. The problem is amplified by two schools, one junior and one senior, and a children's play area adjacent to the road. The bumps were installed in late Nov 1975 and removed in early Nov 1976. Details are given of the method of construction, public reaction, and effects on traffic, pedestrians, and accidents. The speed control bumps on this road appeared to be effective in reducing vehicle speed and traffic flow and to be beneficial to safety. They were acceptable to the majority of residents and drivers. There is evidence that a proportion of the traffic diverted from Cuddesdon Way used alternative routes through the estate, but this did not appear to lead to an increase in accidents on those routes.

by R. Sumner; J. Burton; C. Baguley  
Transport and Road Res. Lab., Road User Characteristics Div., Crowthorne, Berks., England  
Rept. No. TRRL-SR-350; 1978; 32p 4refs  
Availability: Corporate author

HS-023 648

### **PUBLIC TRANSPORTATION IN RURAL AND SUBURBAN AREAS**

A compilation of eight papers concerning public transportation in rural and suburban areas is presented. Topics discussed are as follows: innovative approaches to rural transportation, impacts of rural transit funding options, rural transportation costs, a Poisson model of rural transit ridership, Rural Hwy. Public Transportation Demonstration Prog. evaluation, attitudes toward transit service in small urban areas, public transportation planning for the suburbs, and Georgia's critical rural public transportation needs.

National Acad. of Sciences, Transportation Res. Board, 2101 Constitution Ave., N.W., Washington, D.C. 20418  
Rept. No. TRR-661; 1978; 48p refs  
Availability: TRB \$3.00

HS-023 649

### **OPTIMIZER INVOKES ADAPTIVE STRATEGY FOR BEST SPARK ADVANCE [IGNITION TIMING]**

The operation, preliminary test results, and potential commercialization of the Optimizer, an adaptive control device for optimum ignition timing, are discussed. The Optimizer seeks out that spark advance yielding maximum rpm at any given load. Its "dithering" routine oscillates spark advance ever so slightly, while a single sensor monitors corresponding changes in engine speed. A logic module analyzes the effect of dithering and adjusts spark advance incrementally in the direction of increasing rpm. At its current level of refinement, the Optimizer also incorporates a bias adjustment to avoid incipient knock and to enhance compatibility with EGR (exhaust gas recirculation). A recent evaluation by the National Bureau of Standards' Energy-Related Inventions states that the Optimizer has a reasonable chance of meeting its potential for fuel economy improvements, very conservatively estimated at 10%. This study also notes that long-range commercial prospects for the Optimizer are favorable, but only under certain conditions. In particular, the fact that the device has been known for more than a decade is perhaps to its disadvantage. On the other hand, it is only during the same decade that fuel economy and emission matters have taken on such critical stature. The study suggests that refinements of the Optimizer will have to come quickly to keep up with auto makers' accelerated development of competing systems. Among issues to be addressed are Optimizer manufacturing costs, maintenance, fuel efficiency, emission-control compatibility, and credibility.

Publ: Automotive Engineering v86 n7 p36-9 (Jul 1978)  
1978  
Based on Office of Energy-Related Inventions Document 3017/001355, National Bureau of Standards.  
Availability: See publication

HS-023 650

### **INFLUENCE OF COMBINED HIGHWAY GRADE AND HORIZONTAL ALIGNMENT ON SKIDDING**

A multifaceted investigation was made of the problem of skidding on highway sections containing the combination of horizontal curvature and vertical grade, the objective being to develop tentative guidelines for highway geometrics and pave-

ment surface characteristics to ensure adequate vehicle control during anticipated maneuvers on such highway sections. Accident records for several years from the Ohio and Pennsylvania Turnpikes were examined for influences of curvature and grade, both separately and in combination. There did not appear to be a particularly high accident experience associated with downgrade curves, but the accident rate on curves of about 1 degree on the Ohio Turnpike was more than twice the overall rate. Wet-pavement accidents were also definitely overrepresented on curves of about 1 degree. Simulation and analytical studies of a wide variety of vehicle, tire, road surface, geometric, and maneuver combinations were conducted to determine operating conditions that can lead to loss of control and the onset of skidding. Drivers are not likely to lose control of their vehicles on curve-grade sites unless they attempt severe maneuvers on slippery road surfaces with fair-to-poor tires. Pavement width and cross slope are the primary factors affecting pavement surface drainage. The thickness of water film on a long-radius curve, with a two-lane roadway and paved shoulder sloping in the same direction, can be almost twice that on a crowned tangent section with the same cross slope. The two high-accident field sites investigated were located on 1 degree curves. In both cases, two paved lanes were sloped in the same direction. The essential finding from the various studies is that drainage of the pavement surface is a very important consideration that is sometimes overlooked in pavement cross-section design. Water thickness on the pavement has a critical influence on the friction available at the tire-pavement interface and thus on the safe operation of vehicles. Tire hydroplaning is commonly considered to be the primary adverse effect from excess water on the pavement. In actuality, complete hydroplaning is probably a rare occurrence. Partial hydroplaning (degradation of tire-pavement frictions as a consequence of the presence of water) is the most likely cause of higher than normal wet-weather accidents on long-radius curves with inadequate cross slope in relation to drainage length. Compliance with the design superelevation values for various degrees of curvature and design speeds found in Tables III-7 to III-10 of AASHTO's (American Assoc. of State Hwy. and Transportation Officials) Policy on Geometric Design of Rural Highways, 1965 (GDRH), is recommended, as well as attention to roadway geometry, signing, and maintenance practices to reduce severe maneuvers on curves. A rationale is presented for defining the maneuver demand potential along the length of the roadway as a highway design aid, and a form has been developed to record the pertinent roadway factors.

by D. F. Dunlap; P. S. Fancher; R. E. Scott; C. C. MacAdam; L. Segel  
University of Michigan, Hwy. Safety Res. Inst., Ann Arbor, Mich.  
Rept. No. NCHRP-184; 1978; 43p 13refs  
Sponsored by American Assoc. of State Hwy. and Transportation Officials in cooperation with Federal Hwy. Administration.  
Availability: TRB \$3.20

HS-023 651

### GUARDS ON TRUCKS TO PREVENT CAR UNDER-RIDE

Following a definition of the problem of passenger cars crashing into the rear of trucks with the truck bed passing through the car windshield, and a review of the literature concerning crash testing of underride protection devices, results are presented for an experimental program of three passenger car

crashes into unprotected or protected truck beds. It was found that a car colliding at 15 km/h with an unprotected truck bed sustained significant reduction of occupant headspace. At an impact speed of 25 km/h, intrusion of the truck bed caused a reduction in occupant headspace that might have fatal consequences in real crashes. Even for an occupant restrained by a retractor three-point lap/sash seat belt, the intrusion at the higher speed may be enough to produce serious or fatal head injuries. The addition to the truck frame of a simple, rigid underride guard can transform a fatal crash, including a crash involving restrained front seat car occupants, into an easily survivable one, at impact speeds up to 25 km/h or more. The addition of an underride guard would reduce the severity of such crashes, even at higher speed. The underride guard suitable for such survival could be made considerably lighter and less expensive than the Australian Draft Regulations require. The Swedish regulations for underride protection are appended.

by David A. Simons; Neil Gillies  
Department of Motor Transport, New South Wales, Traffic Accident Res. Unit, Rosebery, N.S.W., Australia  
Rept. No. 6/77; 1977; 44p 13refs  
Sponsored by Commonwealth Government of Australia, through the Transport (Planning and Research) Act, 1974.  
Availability: Corporate author

HS-023 652

### FOREIGN VENDORS: THE NEW 'IMPORT' BOOM [AUTOMOTIVE PARTS]

An increasing foreign involvement in the U.S. auto industry manifested in many ways. It includes foreign component manufacturers establishing U.S. facilities, as well as foreign investors snapping up automotive supplier companies formerly controlled by American shareholders. It also involves purchases by U.S. auto makers of foreign-produced components, although this activity tends to be short-lived. The new "import" boom is prompted by many factors. Low stock prices of many U.S. companies have made them attractive targets of cash-rich foreign firms. Shipping costs, especially for large components, have become increasingly expensive, and the threat of dock strikes hangs heavy over importers. Proximity to market is yet another strong reason for locating near to U.S. customers, and the shrinking value of the dollar has increased the cost of some imported components to a point where they stand to lose their price competitiveness. Despite these obstacles, U.S. auto makers continue to import certain components for other reasons. Although the tempo is rising, foreign suppliers have been represented in the U.S. for years. Typical is Lucas Industries Ltd., the British company whose operations in the U.S. date back to 1948 when it began selling repair parts to MG owners. Last year Lucas set up U.S. headquarters in Troy, Michigan, and has since moved aggressively to capture a slice of the U.S. components market. Ford Custer Industrial Park (near Battle Creek, Michigan) designated a free trade zone, now houses six overseas companies (Keiper A.G., a West German auto seat component manufacturer; TSK Co. Ltd., a subsidiary of Nippon Cable Systems Inc., a Japanese manufacturer of control cables; Fibrit KG, a German auto filter maker; Pratt Bernard Ltd. of the U.K., another auto parts supplier; a joint venture of Germany's Mann-Hummel and a U.S. company, Aero-Mobility Systems, Inc., also making auto filters; and a German manufacturer of steel plates). Many of the largest plants under foreign ownership have located in the South (e.g. VW's original assembly plant in Texas, French-owned Michelin Tire Corp.'s first plant in South Carolina and now expanding into

January 31, 1979

HS-023 655

Alabama, and Robert Bosch Corp.'s recently expanded fuel injection equipment plant in Charleston, South Carolina). Domestic companies reporting to foreign stockholders include the Budd Co., the Euclid Div. of White Motor Co., and Western Batteries Inc. Even more complicated than direct investment is the complex web of entanglements between U.S. companies and their overseas counterparts. Heavy U.S. investment in Europe and Japan since the mid-1950's means that today many "foreign" suppliers are at least partly owned by U.S. firms. In other cases, wholly owned subsidiaries supply parts for U.S. cars from an overseas source. As componentry is downsized, sources for these components are most likely Japan or Europe.

by Daniel F. McCosh

Publ: Ward's Auto World v14 n7 p41-2, 44 (Jul 1978)

1978; 1ref

Availability: See publication

HS-023 653

### EXPOSURE OF DRIVERS TO CARBON MONOXIDE

Eleven new cars were driven around a 35-km route comprising heavily trafficked roads in and around London, and the concentrations of carbon monoxide (CO) inside and immediately outside the vehicles were continuously monitored. Average levels of CO between 12 ppm and 60 ppm were found inside the cars; and these levels were between 30% and 80% of the external concentrations. The internal levels varied according to external changes, but the changes were greatly damped by the buffering effect of the ventilation system. Differences in internal CO levels were more marked among vehicles than for different runs in the same vehicle, and were probably due to differences in the ventilation systems. Blood carboxyhemoglobin concentrations which would arise from the CO exposures were calculated. Published data suggest that carboxyhemoglobin concentrations within the range found (1.5% to 3.0%) would not be expected to produce an adverse effect on health; there are conflicting views as to whether driving performance would be impaired.

by A. J. Hickman; M. R. Hughes

Transport and Road Res. Lab., Environment Div.,  
Crowthorne, Berks., England

Rept. No. TRRL-LR-798; 1978; 29p 22refs

Availability: Corporate author

HS-023 654

### ECONOMIC EFFECTS OF METALLIC CORROSION IN THE UNITED STATES. PT. 1. A REPORT TO THE CONGRESS BY THE NATIONAL BUREAU OF STANDARDS

The study was designed to provide a reference to allow the economic impact of corrosion to be compared with other factors affecting the economy. A significant feature of the study is that the method employed, input/output (I/O) analysis (a modified version of the Battelle Columbus Labs. (BCL) National Input/Output Model), provides a methodological framework that permits comprehensive treatment of all elements of the costs of corrosion (e.g. production costs, capital costs, and changes in useful lives). The I/O model allows analysis of interindustry relationships in the national economy and attribution of relative costs to specific segments of the economy. While there have been previous estimates of the costs of

corrosion, none has provided a focused effort based upon a sound technical-economic method, and none included the indirect effects of corrosion. The total cost of corrosion in the U.S. in the 1975 is estimated to be \$70 billion, about 4.2% of the Gross National Product (GNP). Of this amount, about 15% is estimated to be avoidable under criteria developed in the study. This means that approximately \$10 billion could be available for other uses through the economic use of presently available technology. An uncertainty of about plus or minus 30% for the total corrosion cost figure results from inadequate data in some areas and unsure technical and economic judgments. The uncertainty in avoidable costs is considerably greater. One important aspect of this study is its placement of a full range of maintenance and replacement problems into an economic context that affords a measure of the severity of these problems and provides estimates of where and how the impacts of corrosion are felt. The methodology established, moreover, gives a basis for placing industrial corrosion costs data on a common scale thus rendering existing data and future data more comparable and valuable. An appendix (A) provides an estimation of the uncertainties in the final estimate of the cost of corrosion as determined by BCL, and the uncertainty in its elements.

by L. H. Bennett; J. Kruger; R. L. Parker; E. Passaglia; C. Reimann; A. W. Ruff; H. Yakowitz; E. B. Berman  
National Bureau of Standards, Washington, D.C. 20234;  
Edward B. Berman Associates, Inc., Box 366, Marblehead,  
Mass. 01945

Rept. No. NBS-SP-511-1; 1978; 69p 24refs

Appendix B (BCL Rept.) is HS-023 655. Appendix C is I/O matrix tables. Analysis contracted to Battelle Columbus Labs.  
Availability: GPO \$2.30, Stock No. 003-003-01926-7

HS-023 655

### ECONOMIC EFFECTS OF METALLIC CORROSION IN THE UNITED STATES. PT. 2. APPENDIX B. A REPORT TO NBS [NATIONAL BUREAU OF STANDARDS] BY BATTELLE COLUMBUS LABORATORIES

An analysis of the cost of metallic corrosion to the U.S. was undertaken in order to provide a reference to allow the economic impact of corrosion to be compared with other factors affecting the economy. This analysis was conducted for the National Bureau of Standards (NBS) which had received a Congressional directive to perform such a study. The results provide a basis for development of technological, legislative, and other initiatives to promote effective economic savings. The study was confined to corrosion of metals. A modified form of Battelle's National Input/Output Model provided the methodological framework for estimation of corrosion costs, and permitted detailed and comprehensive treatment of all elements of the costs of corrosion. Production costs, capital costs, changes in replacement lives, etc., were treated in a coordinated and systematic manner. First, the impact of corrosion on the U.S. economy, the approach taken in the study, and several principal concepts used throughout the study are presented and discussed. Following this discussion is a description of Input/Output (I/O) analysis and the specific features used in the application to the determination of the costs of corrosion. Next, data gathering procedures, treatment of each element of costs of corrosion, and description of estimates of corrosion costs are considered. Finally, results of the study are reported which include the following statistics on total costs of corrosion for 1975 as the base year: total costs

to U.S., \$82 billion (1.9% Gross National Product (GNP)); avoidable costs, \$33 billion (2.9% GNP); and unavoidable costs, \$49 billion (2.0% GNP). The following three areas were identified for more detailed analysis: Federal government, electric power generation, and personally-owned automobiles. Costs of corrosion in these areas are discussed in appendices; a list of industrial sector titles for the I/O Model is also appended. Additionally provided are a glossary of terms and a corrosion bibliography of 418 references.

by J. H. Payer; D. G. Dippold; W. K. Boyd; W. E. Berry; E. W. Brooman; A. E. Buhr; W. H. Fisher  
Battelle Columbus Labs., 505 King Ave., Columbus, Ohio 43201  
NBS-7-35716  
Rept. No. NBS-SP-511-2; 1978; 253p refs  
NBS Rpt. is HS-023 654. Appendix C is I/O matrix tables.  
Availability: GPO \$4.25, Stock No. 003-003-01927-5

HS-023 656

### WYOMING TRUCK ACCIDENT FACTS 1977

Statistical data relating to truck-involved accidents which occurred on Wyoming streets and highways during 1977 are presented in the form of graphs, tables, and commentary. Data are presented for commercial-type vehicles only. The data analyzed and presented came from individuals' accident reports and investigating officers' reports (city police departments, sheriffs' offices, and the Wyoming Hwy. Patrol). During 1977, 1486 truck-involved accidents occurred in Wyoming. These accidents resulted in 53 fatalities, 796 injured, and an economic loss of over \$14 million. The number of truck-involved accidents increased 12% in 1977 over 1976, while the total number of persons killed remained the same as in 1976 and the number of injured persons increased 28% over the 1976 figure of 621.

by D. G. Pruter; Ron Skidmore; Tom Jones; Garry Steen  
Wyoming State Hwy. Dept., Hwy. Safety Analysis Section,  
P.O. Box 1708, Cheyenne, Wyo. 82001  
1978; 47p  
Availability: Corporate author \$2.00

HS-023 657

### WASHINGTON STATE SEAT BELT STUDY 1970-1977. SUMMARY OF STATISTICS ON THE CHILDREN AGE 0-15 YEARS WHO WERE PASSENGERS IN MOTOR VEHICLES INVOLVED IN ACCIDENTS

During the period 1 Jan 1970-31 Dec 1977, the Washington State Patrol recorded 94,405 children from birth to age 15 years who were passengers in motor vehicles involved in reportable accidents. Of this group 81,462 (86.2%) were not restrained at the time of the accident, and 12,943 were restrained by seat belts or some other restraining device (13.7%). The children were divided into two age groups: 0-5 years and 6-15 years. Of the 31,602 children from 0-5 years in motor vehicle accidents, 26,550 were not restrained and 5,052 were (16%). One hundred twenty-two of the unrestrained preschool children were killed (ratio 1:216) and 678 had disabling injuries (ratio 1:39). The difference between deaths and disabling injuries between the restrained and unrestrained preschool children was highly significant. If all of the children in the 0-5 age group had been restrained at the time of the accident, then the reduction in deaths may have been reduced

from 124 to 13 (down 90%) and disabling injuries reduced from 716 to 238. Of the three childhood age groups identified in the Washington State Seat Belt Study (0-5 years, 6-15 years, 16-19 years), the use of restraining devices offered the best protection from injury and death for the 0-5 age group. As the child becomes older and larger, the degree of protection from the restraints analyzed in this study appears to be reduced. However, the reduction in injury and death is still significant. For instance, the fatality: passenger ratio for unrestrained 6-15 year old children was 1:252 compared to a ratio of 1:1578 for restrained children. If all children age 15 years or younger had been restrained, the death rate may have been reduced 85% and disabling injuries 66% based on a noncritical analysis of the statistics produced from this study. This eight-year study offers well-documented proof that seat belts and other restraining devices for children reduce injury and save lives. Adults must be made to realize that the child passenger has special requirements and must have adequate protection to reduce suffering and unnecessary waste of life.

by Robert G. Scherz  
Mary Bridge Children's Health Center, 311 South L St.,  
Tacoma, Wash. 98405  
1978; 17p  
Availability: Corporate author

HS-023 658

### ESTIMATION OF TRAFFIC VARIABLES USING POINT PROCESSING TECHNIQUES. FINAL REPORT

An alternative approach to estimating aggregate traffic variables on freeways, spatial mean velocity and density, is presented. Vehicle arrival times at a given location on a roadway, typically a presence detector, are regarded as a point or counting Poisson process whose rate is a function of the state of the traffic at every instant of time. Moreover, the traffic state is modeled as a finite-state Markov chain. A sequential point process filter, optimum in the mean-squared error sense, is designed to estimate the state from observations of the vehicle arrival-time sequence. Different possibilities for incorporating potential additional information, such as speed and headway, are explored. Parameter values for the underlying Markov chain are obtained via a maximum likelihood estimator. Qualitative behavior of the proposed algorithms is studied with simulated traffic flow data from both macroscopic and microscopic models.

by R. L. Lopez; P. K. Houpt  
Massachusetts Inst. of Tech., Electronic Systems Lab.,  
Cambridge, Mass. 02139  
DOT-TSC-849  
Rept. No. DOT-TSC-RSPA-78-9; 1978; 81p 20refs  
Rept. for Apr 1976-Apr 1977. Based on Master's thesis by R.L. Lopez, Massachusetts Inst. of Tech.  
Availability: NTIS

HS-802 402

### SAN ANGELO UNIFORM TIRE QUALITY GRADING TEST CENTER. INDUSTRY USERS MANUAL

A description is presented of the Dept. of Transportation's San Angelo Uniform Tire Quality Grading (UTQG) Test Center, and the procedures applicable to treadwear and traction testing that may be performed at this center are delineated. Sections of the manual deal with the test center's general description (area, test center, treadwear and traction

courses, emergency medical services, and emergency telephone numbers), general instructions applicable to all testing organizations (senior representative responsibilities, vehicle parking and fueling, test vehicle identification, restricted areas, business/personal communications, and assistance from National Hwy. Traffic Safety Administration (NHTSA) personnel), Goodfellow AFB administrative instructions (waiver and hold harmless agreement, vehicle registration and operation, and visitors instructions), tire procurement instructions (requests, payment, procurement documentation, withdrawal of tires, and ASTM (American Society for Testing and Materials) E501 tires), treadwear testing instructions (scheduling, treadwear testing, driving procedures, tire measurements, unscheduled test vehicle parking, and test vehicle driver recruiting), and traction testing instructions (scheduling and traction testing). Maps and samples of forms and documents are included.

National Hwy. Traffic Safety Administration, Office of Standards Enforcement, Washington, D.C. 20590  
1977; 38p

Manual corrected Aug 1977.

Availability: NHTSA

HS-803 191

#### **DAMAGE TO VEHICLE SAFETY AND ENGINE EXHAUST SYSTEMS IN COLLISIONS. FINAL REPORT**

A study was made of 288 collision-damaged vehicles of the model years 1968-1977 with regard to damage to their safety and engine exhaust emission systems and for precollision non-compliance with established standards. Data were evaluated for statistically significant damage occurrence and/or precollision noncompliance, and correlations between statistically significant occurrences of damage and substandard operation associated with the type of accident and extent of crash damage. A statistically large number of accident-involved vehicles had poor components in their brake system: the friction material was thinner than considered a safe level on 27%; 31% had low brake fluid; 33% showed alignment problems. Excessive hydrocarbons were emitted at idle by 20%, and at 2500 rpm by 11%. Of pollution control devices inspected, 15% required air cleaner replacement and 8% had some pollution control devices disconnected. Energy-absorbing bumper systems were damaged on 17% of the vehicles. Lamps were damaged in 22% of the accidents and were not functioning properly prior to the accident on another 22%; reflecting devices showed a similar pattern. Power steering belts were loose or worn on 15% of the cars and 9% exhibited transmission level misalignment. Fuel tank connections were leaking on 7%; the exhaust system was faulty on 27%; windshield washers did not work or were not filled with fluid on 25% of the vehicles. Appended are extensive data on safety and exhaust emission; it is recommended that they be compared with similar data collected from a representative sampling of vehicles on the road which have not been involved in accidents. It is also recommended that future programs include data on brake lining contamination, brake caliper inspection, brake self-adjusting screw, horn, and a more rigid inspection for safetybelt usage.

by John N. Noettl  
Automobile Club of Missouri, 201 Progress Pkwy., Maryland Heights, Mo. 63043  
1977; 158p

Availability: Technical Reference Branch, microfiche only

HS-803 290

#### **FIELD STUDY OF A VARIABLE-HEIGHT HIGHWAY-NOISE BARRIER. FINAL REPORT**

The design, construction, and evaluation of a variable-height highway-noise barrier are described in a study to obtain baseline statistical data for use in assessing the performance of roadside barriers under actual field conditions. Past measurements of roadside-barrier performance have been limited. In most cases, the noise levels behind an existing barrier have been measured and compared with levels at a point above or in front of the barrier. Unfortunately, in these cases, the performance of the barrier in reducing noise cannot be determined directly since noise levels in the community behind the barrier, without the barrier in place, are not known. The usual practice is to assume that the noise levels measured above or in front of the barrier are unaffected by its presence. These levels are then used to predict the levels in the community without the barrier in place. It follows that errors in prediction of the community noise levels will transmit directly to errors in the assessment of barrier performance. In this study, a barrier was constructed along a 1000-ft-long segment of Interstate 93 in Andover, Massachusetts. A test plan was prepared, and measurements were taken at a number of points behind the barrier and at an adjacent acoustically-similar open site using the DOT (Department of Transportation)-TSC (Transportation Systems Center) Mobile Noise Lab. Data were collected over a series of eight tests, each extending over a two-day or three-day period to determine the noise reduction provided by barriers of different heights with reflecting or absorbing surfaces. The barrier was found to be effective in reducing noise from traffic. As a rule, the noise reduction was found to increase with barrier height. The noise reduction was found to decrease as the distance between the barrier and measurement point increased. Existing design charts (NCHRP 144 Design Guide) are inadequate for predicting the performance of highway-noise barriers. The design-chart correction for finite-barrier length is believed to be too large. Of the factors not included in the design-guide prediction procedure, ground effect appears most likely to account for the discrepancy between measured and predicted insertion loss. Future research is needed to obtain a better knowledge of how sound propagates away from a road over various terrains which may lead to more creative and less expensive solutions to highway-noise control than currently feasible.

by J. E. Manning; C. N. Blair  
Cambridge Collaborative, Inc., 238 Main St., Cambridge, Mass. 02142

DOT-TSC-1011

Rept. No. DOT-TSC-NHTSA-78-23; 1978; 72p 13refs

Rept. for Apr 1975-Nov 1976.

Availability: NTIS

HS-803 322

#### **CHILD RESTRAINT SYSTEMS EVALUATION USING BABOONS AND CHILD-SIZED DUMMIES. VOL. 1. FINAL REPORT AND APPENDICES A-C**

Impact tests were carried out on the Aerospace Medical Res. Lab.'s Impulse Accelerator Facility to evaluate the relative performance characteristics in child restraint systems of two proposed three-year-old child dummies, the Civil Aeromedical Inst.'s CAMI dummy, and an Alderson VIP-3C dummy. Side-by-side impact comparisons were made in the forward and lateral impact directions at velocities ranging up to 30 mph.

Performance of the dummies was compared with the responses of juvenile baboons used as surrogates for the three-year-old child. Comparisons were made using three types of child restraints on a standardized automobile bench seat. Data to make the comparisons were restraint loads, head and chest accelerations, and kinematic displacement of various body parts. The results showed that there were significant differences between the two dummies. Neither dummy provided a good match to the young baboon responses, at least in terms of Head Injury Criteria (HIC) value, although the CAMI dummy produced HIC values nearer those measured on the baboon than on the VIP dummy. Two major deficiencies in the impact testing of restraint systems were revealed: procedures and methods for nondummy instrumentation and data processing must be developed, and dummy evaluations in terms of predicting human response or injury cannot be well made. Appendix A contains the head and chest resultant accelerations from both the internal and external accelerometer groups. Appendix B gives the peak acceleration for the x axis and resultant. Severity indices computed for the x acceleration alone and on the resultants are listed. Appendix C is concerned with the HIC index calculation. HIC values are given and the time interval from which they were calculated.

by John T. Shaffer; Robert M. Letscher  
Aerospace Medical Res. Lab., Wright-Patterson AFB, Ohio 45433  
DOT-HS-017-1-017-1A  
Rept. No. AMRL-TR-76-99-Vol-1; 1976; 315p 2refs  
Rept. for Aug 1974-Oct 1975. Subcontracted to Dynalelectron Corp., subcontract-F33615-74-C-4050, and Univ. of Dayton Res. Inst., subcontract-F33615-73-C-4157. Vol. 2 is HS-803 323.  
Availability: NTIS

HS-803 323

#### **CHILD RESTRAINT SYSTEMS EVALUATION USING BABOONS AND CHILD-SIZED DUMMIES. VOL. 2. APPENDICES D AND E**

Appendix D provides the subject displacement plots and the raw x-y coordinates for all points tracked in the testing. The times given for each subject within a test are identical. Appendix E furnishes the impact data as a function of time in oscillograph form. Each location is covered and represents the waveform for that data point.

by John T. Shaffer; Robert M. Letscher  
Aerospace Medical Res. Lab., Wright-Patterson AFB, Ohio 45433  
DOT-HS-017-1-017-1A  
Rept. No. AMRL-TR-76-99-Vol-2; 1976; 369p  
Rept. for Aug 1974-Oct 1975. Subcontracted to Dynalelectron Corp., subcontract-F33615-74-C-4050, and Univ. of Dayton Res. Inst., subcontract-F33615-73-C-4157. Vol. 1 is HS-803 322.  
Availability: NTIS

HS-803 336

#### **TECHNICAL REPORTS OF THE NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION; A BIBLIOGRAPHY, 1977**

This bibliography cites technical reports published during 1977. Citations follow the format used in the monthly abstract journal Highway Safety Literature and are indexed by a key-word-out-of-context (KWOC) listing, author, corporate author, contract number, and report number. Documents listed herein

may be examined in the Technical Reference Branch, National Hwy. Traffic Safety Administration (NHTSA). Few of the documents are available for distribution by NHTSA. Availability is given in individual citations.

by Lois Flynn, comp.  
National Hwy. Traffic Safety Administration, Technical Services Div., Washington, D.C. 20590  
Rept. No. SB-28; 1978; 316p  
Supplement to DOT-HS-801 200, DOT-HS-801 895, and DOT-HS-802 518.  
Availability: NTIS

HS-803 340

#### **DIFFERENCES AMONG TRAFFIC LAWS IN THE UNITED STATES**

A discussion of 1976 traffic laws in the U.S. that substantially differ from the Uniform Vehicle Code (UVC) and traffic laws in other states is presented. The provisions of the laws are outlined for the following categories: traffic control signals (pedestrians and red lights, pedestrians and yellow lights, turning right on red, drivers and yellow lights, drivers at green lights, and drivers stopped at red lights); right of way rules (uncontrolled intersection rule, shifting rules, stop signs, yield signs, drivers entering highway from adjacent land, and yielding to authorized emergency vehicles); pedestrians (yielding to pedestrians in crosswalks, yielding by pedestrians outside crosswalks, avoid striking pedestrians, and hitchhiking); stopping for school buses; prima facie speed limits; riding motorcycles and bicycles single file; drunk driving laws (places where laws apply, and illegal per se laws); and position on the roadway (drive on right, driving around an obstruction, driving on roadways with three lanes, when use of the right lane is required, blow horn before passing, passing on the right, no passing zones, and painted medians). While some of the 399 differing rules may be less important for safe and sound highway usage than others, 50% of these differences involve right of way and signal indications. Several states do not have laws requiring drivers to yield to pedestrians in crosswalks nor laws requiring pedestrians at other locations to yield to vehicles. Some states also do not have the rule requiring drivers to avoid striking pedestrians. State laws dealing with drivers' duties toward children around school buses are not uniform; many states allow or require the use of flashing red lights on moving buses and there is disagreement as to when drivers must stop. Prima facie speed limits are still in effect in 16 states. Forty states have not yet adopted laws prohibiting a person from driving with more than a specified amount of alcohol in the blood. Several states require bicycles and motorcycles to be ridden single file. Many states do not yet authorize driving on the left side of the roadway to get around an obstruction. Several states have laws which require drivers to be in the right lane except when passing. Eight states require motorists to blow their horns before passing. Two states have a rule allowing the completion of a passing maneuver after entry into a no passing zone.

by Edward F. Kearney  
National Com. on Uniform Traffic Laws and Ordinances  
DOT-HS-5-01121  
Publ: Traffic Laws Commentary v7 n3 (Mar 1978)  
1978; 35p 50refs  
Availability: GPO, Stock No. 050-003-00314-0

January 31, 1979

HS-803 374

HS-803 371

**MOTOR VEHICLE SAFETY 1977. A REPORT ON ACTIVITIES UNDER THE NATIONAL TRAFFIC AND MOTOR VEHICLE SAFETY ACT OF 1966 AND THE MOTOR VEHICLE INFORMATION AND COST SAVINGS ACT OF 1972; JANUARY 1, 1977--DECEMBER 31, 1977**

Chapters include the following: introduction (the record, motor vehicle safety rulemaking plan, priority programs, recent additions to NHTSA (National Hwy. Traffic Safety Administration) responsibilities); the standards summary 1977; data acquisition, analysis, and reporting; crash survivability (occupant protection, vehicle structures, pedestrian protection, biomechanics, integrated vehicle systems program); crash avoidance (vehicle handling, tires and wheels, brakes, the driver and the vehicle); standards enforcement and defects investigation (standards enforcement background, the record, uniform tire quality grading, surveillance of imported nonconforming motor vehicles, defects investigation background, how the job is done, NHTSA and the recall campaigns, safety defect recalls-1977, safety campaign audits, parts return program, recreational vehicle surveys, engineering test facility); automotive fuel economy (summary of functions and interagency relations, standards issued and proposed, regulations and compliance, fuel economy research); litigation and administrative enforcement special programs (international cooperation, no-damage bumper system, electric and hybrid vehicles summary, odometer tampering); the consumer's advocate; research and how it is used; National Motor Vehicle Safety Advisory Council (reports, recommendations); and administration (organizational changes, management improvements, civil rights). Appendices contain the following: statistical compilation, National Motor Vehicle Safety Advisory Council 1977 membership list, funding tables, list of publications of NHTSA, tabulation of current research grants and contracts and the problems they address, and outline of litigation for calendar 1977. The annual report on bumpers required by the Motor Vehicle Information and Cost Savings Act of 1972 is included; additionally, the statutory obligations contained in the Motor Vehicle Information and Cost Savings Act of 1976 with respect to odometer tampering, and how they are being met, are considered.

National Hwy. Traffic Safety Administration, Washington, D.C. 20590  
Rept. No. AR-11; 1978; 150p refs  
Availability: GPO

HS-803 372

**HIGHWAY SAFETY. A REPORT ON ACTIVITIES UNDER THE HIGHWAY SAFETY ACT OF 1966 AS AMENDED JANUARY 1, 1977--DECEMBER 31, 1977**

This is the 11th annual report on the administration of the Highway Safety Act of 1966. Pt. 1 contains chapters on the following topics: Highway Safety Program Standards; data acquisition, analysis, and reporting; safer drivers, pedestrians and vehicles; services that improve traffic safety; international cooperation; the consumer's advocate; research and how it is used; the advisory committees; and administration. Pt. 2 contains chapters on the following topics: highway safety within the Federal Hwy. Administration (FHWA); other highway safety activities; and safety research. Appendices provide the following information: statistical compilation; the National

Hwy. Traffic Safety Advisory Committee's and the Youth Hwy. Safety Advisory Committee's 1977 membership; funding tables; publications of the National Hwy. Traffic Safety Administration (NHTSA) and the FHWA; current research grants and contracts and the problems they address; and litigation for calendar year 1977. Tables for Pt. 1 include information for the following areas: traffic fatalities, 1961-1977; analysis of 1976 traffic accident fatalities; lives saved due to fatality rate reduction; NHTSA's historical and legislative background; ASAP's (Alcohol Safety Action Projects) with significant reduction in night fatal crashes; states rated for conformity with the Uniform Vehicle Code (UVC); research accomplishments and application to highway safety standards; and data acquisition and statistical analysis. Tabulated information for Pt. 2 includes quarterly speed summaries, and highway safety research accomplishments and applications.

National Hwy. Traffic Safety Administration, Washington, D.C. 20590; Federal Hwy. Administration  
1978; 171p refs  
Availability: GPO

HS-803 373

**SAFETY RELATED RECALL CAMPAIGNS FOR MOTOR VEHICLES AND MOTOR VEHICLE EQUIPMENT, INCLUDING TIRES. DETAILED REPORTS FROM OCTOBER 1, 1977 TO DECEMBER 31, 1977**

Detailed information regarding defect recall campaigns conducted by domestic and foreign automobile and equipment and tire manufacturers during the fourth quarter of 1977 is presented. Postal delivery vehicles, automobiles, travel trailers, buses, motor homes, light-duty trucks, trailers, trucks and truck tractors, boat and camping trailers, motorcycles, aluminum wheels, motorcycle helmets, "Shutterstat" fluid, lock nuts, parallel arms, slide-in campers, holding brakes, hubs, antilock wheel speed sensor stators, and tires are included. Correspondence between the National Hwy. Traffic Safety Administration and the companies involved are reproduced, as is other relevant correspondence such as letters to dealers and customers.

National Hwy. Traffic Safety Administration, Washington, D.C. 20590  
1978; 1026p  
Availability: NTIS

HS-803 374

**OPTIMIZED BRAKE INSPECTION. VOL. 1: SUMMARY VOLUME. FINAL REPORT**

by Franklin G. Fisher, Jr.; H. Cook; Fran Oldham; Roger Gloss; Randolph Eidemiller  
Ultrasystems, Inc., 2400 Michelson Dr., Irvine, Calif. 92715; ARTEC, Inc., St. Louis, Mo.  
DOT-HS-6-01383  
Rept. No. US-8304-2; 1977; 32p  
Rept. for Jun 1976-Dec 1977. For abstract, see HS-803 375.  
Availability: NTIS



HS-803 375

# **OPTIMIZED BRAKE INSPECTION. [VOL. 2]. TECHNICAL VOLUME. FINAL REPORT**

In developing an optimized brake inspection program as a function of the critically of brake system failure modes and degradation modes the criticality index was based on four main components: a brake system computer simulation program developed at the Univ. of Illinois; weighting factors, rating a defect's potential for causing an accident, developed from the Univ. of Indiana's Multidisciplinary Accident Investigation (MDAI) Study data; component outage frequencies (probability of being in a defective condition) developed from the Dept. of Transportation's Vehicle-In-Use data bank; and a computer optimization technique (CDC's APEX III) for selecting the optimum inspection program. These four components were utilized to develop certain mathematical relationships that provide a quantitative assessment of the criticality of various brake system defects and at the same time provide a mechanism for quantitatively supporting an optimized brake inspection program. The results indicate the criticality approach provides a most effective means of inspecting brakes and at the same time reduces the number of components that must be inspected as well as determines the optimum intervals at which inspection should be made. The recommendations are to inspect brake fluid level every six months on all cars, to utilize a brake tester on all cars every six months, to inspect all front wheel brake components every six months beginning at a vehicle age of 18 months, and to inspect front brake hose every six months beginning at a vehicle age of three years. Future efforts should include additional MDAI data collection to develop more reliable weighting factors for the criticality index, additional work on the computer simulation model to provide information on a wider range of vehicles and vehicle parameters, the development of criticality indices for other vehicle systems that are known to have a high impact on vehicle safety, dissemination to the states of information on the criticality index approach to inspection, and an evaluation of each state's inspection system based on the inherent evaluation capability of the criticality index. Appended are test instructions and procedures, a statistical analysis of brake components from vehicle-in-use data using SPSS, a section on finding an optimum brake inspection program using APEX III, and a Peterson, Howell and Heather, Inc. (PHH) pre-processing program.

by Franklin G. Fisher, Jr.; H. Cook; Fran Oldham; Roger Gloss; Randolph Eidemiller  
Ultrasystems, Inc., 2400 Michelson Dr., Irvine, Calif. 92715;  
ARTEC, Inc., St. Louis, Mo.  
DOT-HS-6-01383  
Rept. No. US-8304-2; 1977; 307p 6refs  
Rept. for Jun 1976-Dec 1977. For summary report, see HS-803 374.  
Availability: NTIS

HS-803 381

# **MANUAL BRAKE INSPECTION PROCEDURES. VOL. 2: FINAL TECHNICAL REPORT**

Performance and nonperformance (visual) brake inspections were investigated with the object of replacing the current method for performing these inspections in less expensive ways, more suitable for small garages. The performance inspection system that resulted from NHTSA (National Highway Traffic Safety Administration) research on the subject uses a

low-speed dynamometer that has the ability to perform an automated and complete inspection of the performance aspects of vehicle brakes. The result of research on nonperformance inspection is a proposed system that is best suited for future vehicles because it relates to designing the brakes and adjacent assemblies in such a manner as to facilitate external and internal visual inspections by using wear indicators that indicate the state of use or repair of the system. Both systems of brake inspection have disadvantages. Performance inspections have prompted several states and organizations to object to the test requirements in the Vehicle-In-Use (VIU) Inspection Standards (Part 570, Chapter 5, Title 49, Code of Federal Regulations) that call for brake inspections to be accomplished on a roller-type tester. None of the machines currently used for brake testing is acceptable to the states because of higher cost or technical limitations. The nonperformance aspects of the inspection have the disadvantage of necessitating the removal of wheels for inspection and of being potentially subjective. NHTSA felt that it was necessary to generate an interim approach to eliminate the dynamic inspection void until suitably designed equipment can be developed and marketed at a reasonable cost from the viewpoint of both high-capacity and small garages, and to eliminate subjective visual inspection procedures. As a result of the present investigation, a torsion bar dynamometer has been constructed for performance brake inspection that can meet all legislated requirements for VIU performance inspections, previously only possible on machines of more costly design. With respect to visual brake inspection, recommended nonperformance inspection items have been identified.

by T. H. Forman; M. Finigian  
Avco Systems Div., 201 Lowell St., Wilmington, Mass. 01887  
DOT-HS-5-01188  
1976; 204p 6refs  
Availability: NTIS

HS-803 382

# **FREQUENCY DISTRIBUTIONS OF PASSENGER CARS BY WEIGHT AND WHEELBASE BY STATE: JULY 1, 1976**

The report contains frequency distributions and percentages of domestic and imported automobile registrations for each state as of 1 Jul 1976. Vehicles are grouped by 500-pound and 700-pound weight intervals and by 5-inch and 10-inch wheelbase intervals. The data can be used as a measure of the automobile population exposure for accident studies; they also provide a description of the population using two parameters that are related to both occupant crash injury and full consumption. Domestic car information includes a summary of registrations by state, the total U.S. registrations in 100-pound categories and state registrations in 700-pound and 500-pound categories. Imported-car information includes a summary of registrations by state, the total U.S. registrations in 100-pound categories and state registrations in 700-pound and 500-pound categories. Additional large sources of data are available, though expensive to use in terms of analyst and/or computer time.

by Kathy Jatrass; William L. Carlson  
National Hwy. Traffic Safety Administration, National Center for Statistics and Analysis, 2100 2nd St. S.W., Washington, D.C. 20590  
1978; 226p  
Availability: NTIS



HS-803 387

# **SUBSTITUTE FOAMING AGENT FOR THE MANUFACTURE OF PART 572 DUMMY FLESH COMPONENTS. FINAL REPORT**

Since the production of Nitrosan has recently been discontinued, work was undertaken to find a substitute foaming agent in the manufacture of vinyl foam flesh parts of crash test dummies conforming to the Code of Federal Regulations Chapter 49, Pt. 572. Substitute flesh formulations were successfully foamed in the laboratory with an agent comprising a combination of p,p'-oxybis-(benzene sulfonyl hydrazide) and t-butyl peroxyphthalate. The components are available commercially from a variety of domestic suppliers, entail no cost penalty, and present no unusual use hazards. The foams were molded over a suitable, broad thickness range at appropriate densities. Properties were comparable, but not identical, to those of Nitrosan foams, with indicated advantages in resistance to aging and low compression set. The new foams were optimized in structure and physical properties by further formulation development. All requisite dummy skin/flesh parts were produced successfully and reproducibly at a commercial facility with conventional equipment for Nitrosan parts. Batchwise variations in plastisol activity were readily accommodated by minor formula modification. All parts were of suitable external and internal quality. Further improvements in quality and uniformity may be expected with continued manufacturing experience. Appended are SPI-CV (Society of the Plastics Industry - Cellular Vinyl) test methods and drop-weight impact test data.

by William P. Whelan, Jr.; Martin I. Jacobs  
Uniroyal, Inc., Oxford Management and Res. Center,  
Middlebury, Conn. 06749  
DOT-HS-6-01326  
Rept. No. FR-DOT-HS-6-01326; 1978; 218p  
Availability: NTIS

HS-803 388

# **EVALUATION METHODOLOGIES FOR NINE FEDERAL MOTOR VEHICLE SAFETY STANDARDS: FMVSS 105, 108, 122, 202, 207, 213, 220, 221, 222. FINAL REPORT**

The second of two studies to develop methodologies for evaluating nine Federal Motor Vehicle Safety Standards: FMVSS 105, Hydraulic Brake Systems in Passenger Cars; FMVSS 108, Side Marker Lamps and High Intensity Headlamps (only); FMVSS 122, Motorcycle Brake Systems; FMVSS 202, Head Restraints; FMVSS 207, Seating Systems; FMVSS 213, Child Seating Systems; FMVSS 220, School Bus Rollover Protection; FMVSS 221, School Bus Body Joint Strength; and FMVSS 222, School Bus Seating and Crash Protection, is presented. A summary and overview of the sixteen preceding reports, and an integration of the individual approaches for evaluating each standard as presented in the earlier reports, are provided. Conclusions, recommendations, a review of the nine standards, and a review of the approaches to evaluating the standards are included. Statistical analyses of accident data, field and mail surveys, and laboratory testing which comprise the methodologies for the evaluation are discussed, and work plans with clearly defined decision points between various tasks in each evaluation program are presented. The evaluation programs may require from three to six years to complete. The maximum cost of completing all

nine evaluations is estimated to be about \$5.2 million over a six-year period. Appended is a discussion of statistical techniques.

by Gaylord M. Northrop; John T. Ball; Diccon R. E. Bancroft; Joseph C. Reidy, Jr.  
Center for the Environment and Man, Inc., 275 Windsor St.,  
Hartford, Conn. 06120  
DOT-HS-7-01674; DOT-HS-7-01675  
Rept. No. CEM-4228/4229-600; 1978; 201p refs  
Rept. for Aug 1977-Mar 1978. See also HS-803 389--HS-803 394.  
Availability: NTIS

HS-803 389

# **FINAL DESIGN AND IMPLEMENTATION PLAN FOR EVALUATING THE EFFECTIVENESS OF FMVSS 105: HYDRAULIC BRAKE SYSTEMS IN PASSENGER CARS. FINAL REPORT [FEDERAL MOTOR VEHICLE SAFETY STANDARD]**

The final design and implementation plan for evaluating the effectiveness of Federal Motor Vehicle Safety Standard (FMVSS) 105, Hydraulic Brake Systems in Passenger Cars, considers measurability criteria, alternative statistical and laboratory techniques, data availability/collectability, resource requirements, work schedule, and other factors. The standard specifies minimum performance requirements for a number of different braking characteristics such as stopping distance vs. speed, fade and recovery, water recovery, partial failure, and others. The evaluation of the standard cannot be done exclusively with mass accident data, because few records indicate whether or not brake performance was a causal factor in the accident. The standard's requirements cover such a broad spectrum of performance characteristics, there is little distinction between vehicles meeting or not meeting all of the requirements. Therefore, data from a more detailed type of accident reporting such as that of multidisciplinary investigation teams would be required. The plan described takes two general approaches: statistical analysis of available and subsequent multidisciplinary accident data; and acquisition of new test data. To carry out these approaches, five evaluation and cost methodologies are discussed. One evaluation program involves straightforward data processing of existing data. Three other evaluation programs call for acquiring laboratory and field survey data. The program for determining cost of the standard requires obtaining data from the manufacturers. It is estimated that the entire program would take nearly six years, at a cost of about \$873,000. Appended are a copy of FMVSS 105, and discussions of statistical techniques, of dynamic brake testing of a stationary vehicle, and of proposed standard implementation cost categories.

by Edward R. Sweeton; Gaylord M. Northrop  
Center for the Environment and Man, Inc., 275 Windsor St.,  
Hartford, Conn. 06120  
DOT-HS-7-01674  
Rept. No. CEM-4228-588; 1977; 171p refs  
Rept. for tasks 4 and 5. See also HS-803 388, and HS-803 390--HS-803 394.  
Availability: NTIS

HS-803 390

# **FINAL DESIGN AND IMPLEMENTATION PLAN FOR EVALUATING THE EFFECTIVENESS OF FMVSS**

**108: SIDE MARKER LAMPS AND HIGH INTENSITY HEADLAMPS (ONLY). FINAL REPORT [FEDERAL MOTOR VEHICLE SAFETY STANDARD]**

The final design and implementation plan for evaluating the effectiveness of Federal Motor Vehicle Safety Standard (FMVSS) 108, Side Marker Lamps and High Intensity Headlamps (only), considers measurability criteria, alternative statistical techniques, laboratory tests, data availability/collectability, resource requirements, work schedule, and other factors. The overall objective of the standard is accident avoidance. In part, this is achieved by requiring side marker lamps which help drivers notice other vehicles and judge distances during darkness or other conditions of reduced visibility. High intensity headlamps have recently been allowed on passenger cars, and their light output is up to double that of existing headlamps, leading to greater nighttime sighting distances, and possibly more accidents from increased headlamp glare. The plan described contains nine separate evaluation programs; including one on the cost of complying with the standard. The first program uses mass accident data to analyze the effect of side marker lamps in side collisions. The next three programs are experiments: one a laboratory test of the effects of adverse weather on glare from high intensity headlamps, and the second a field study of sighting distance as affected by high intensity headlamps and side marker lamps, and the third, a lab test of side marker lamp conspicuity. If these initial studies are not sufficient to evaluate the effectiveness of high intensity headlamps and side marker lamps additional programs include field data collection at hazardous locations for nighttime performance of cars with high intensity headlamps; analysis of mass accident data for overdriving headlamps and glare complaints; field surveys of lighting system usage, headlamp misaiming (or outage). The ninth program presented is the cost sampling plan. It is estimated that the evaluation of side marker lamps and high intensity headlamps could be carried out in about four years at a cost of about \$557,000. Appended are a copy of FMVSS 108, and a discussion of statistical techniques.

by Joseph C. Reidy; Gaylord M. Northrop  
Center for the Environment and Man, Inc., 275 Windsor St.,  
Hartford, Conn. 06120  
DOT-HS-7-01674  
Rept. No. CEM-4228-589; 1977; 147p refs  
Rept. for tasks 4 and 5. See also HS-803 388, HS 803 389, and  
HS-803 391--HS-803 394.  
Availability: NTIS

HS-803 391

**FINAL DESIGN AND IMPLEMENTATION PLAN FOR EVALUATING THE EFFECTIVENESS OF FMVSS 122: MOTORCYCLE BRAKE SYSTEMS. FINAL REPORT [FEDERAL MOTOR VEHICLE SAFETY STANDARD]**

The final design and implementation plan for evaluating the effectiveness of Federal Motor Vehicle Safety Standard (FMVSS) 122, Motorcycle Brake Systems, considers measurability criteria, alternative statistical techniques, laboratory tests, data availability/collectability, resource requirements, work schedule, and other factors. The overall objective of the standard is accident avoidance, to be achieved by specifying required equipment for motorcycle brakes and establishing performance test procedures for these systems. The goals of the standard are to improve motorcycle braking performance

by increasing stopping capabilities and decreasing stopping distances, and to avoid accidents by ensuring safe motorcycle braking performance under both normal and emergency conditions. The extent to which the standard achieves these goals is obscured by the fact that accident-avoidance braking performance requires rather precise hand and foot coordination, and is highly dependent upon the braking abilities of the rider. The plan described contains five coordinated evaluation programs, plus one for determining additional costs due to the standard. The first study analyzes mass accident data in relation to accident avoidance, injury reduction and effects of brake failure. The second study is a three-part data collection survey of motorcycle riders, tires, and modifications made to motorcycles. The third study, an analysis of National Accident Sampling System (NASS) and California accident data, is very similar to the first task. Study number four is a dynamometer test of motorcycle brakes in a controlled laboratory setting. The fifth task uses volunteer and professional riders to test the performance capabilities of motorcycle brakes and to analyze the behavior of motorcycle riders. The last study is the cost data analysis. The entire program would take three years to complete, at a total cost of \$348,000. Appended are a copy of FMVSS 122, a discussion of statistical techniques and of proposed standard implementation cost categories, and an analysis of Cycle Guide road tests of 1974 and 1975 motorcycles.

by Kayla Costenoble; Stephen J. Thoren; Gaylord M. Northrop  
Center for the Environment and Man, Inc., 275 Windsor St.,  
Hartford, Conn. 06120  
DOT-HS-7-01674  
Rept. No. CEM-4228-590; 1977; 138p refs  
Rept. for tasks 4 and 5. See also HS-803 388--HS-803 390, and  
HS-803 392--HS-803 394.  
Availability: NTIS

HS-803 392

**FINAL DESIGN AND IMPLEMENTATION PLAN FOR EVALUATING THE EFFECTIVENESS OF FMVSS 202: HEAD RESTRAINTS, AND FMVSS 207: SEATING SYSTEMS. FINAL REPORT [FEDERAL MOTOR VEHICLE SAFETY STANDARD]**

The final design and implementation plan for evaluating the effectiveness of Federal Motor Vehicle Safety Standard (FMVSS) 202, Head Restraints, and FMVSS 207, Seating Systems, considers measurability criteria, alternate statistical techniques, laboratory tests, data availability/collectability, resource requirements, work schedule, and other factors. The overall purpose of FMVSS 202 is to reduce the frequency and severity of neck injury in rear end and other collisions, to be achieved by establishing requirements for head restraints in passenger cars. The overall purpose of FMVSS 207 is to reduce the incidence of seat failures and their contributions to fatalities and injuries, to be achieved by establishing strength requirements for seating systems and requiring a self-locking restraining device for folding seat backs. The integrated plan for evaluating the effectiveness of these two standards contains eight separate evaluation programs, including one for additional costs due to the standards. One program focuses on neck injury insurance claims; another employs detailed accident data to evaluate both head restraints and seating systems. A third program analyzes fatalities to investigate the effects of self-locking seat backs. The fourth and fifth programs evaluate mass accident data and newly collected head

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restraint usage data. Both standards are evaluated with laboratory tests in the sixth program, and through instrumenting vehicles in the field in the seventh program. The eighth program is for cost data acquisition. The entire program to evaluate both standards would require a six-year period, and an estimated cost of \$1,355,000. However, early successful evaluation of FMVSS 202 and restricting the evaluation of FMVSS 207 to the effects of seat back locks could drastically reduce costs to \$268,000. Appended are copies of FMVSS 202 and 207, and discussions of statistical techniques, of proposed standard implementation cost categories, and of seating system failure modes.

by John T. Ball; Joseph C. Reidy; Gaylord M. Northrop  
Center for the Environment and Man, Inc., 275 Windsor St.,  
Hartford, Conn. 06120  
DOT-HS-7-01675  
Rept. No. CEM-4229-596; 1977; 161p refs  
Rept. for tasks 4 and 5. See also HS-803 388--HS-803 391, HS-803 393, and HS-803 394.  
Availability: NTIS

HS-803 393

**FINAL DESIGN AND IMPLEMENTATION PLAN FOR  
EVALUATING THE EFFECTIVENESS OF FMVSS  
213: CHILD SEATING SYSTEMS. FINAL REPORT  
[FEDERAL MOTOR VEHICLE SAFETY STANDARD]**

The final design and implementation plan for evaluating the effectiveness of Federal Motor Vehicle Safety Standard (FMVSS) 213, Child Seating Systems, considers measurability criteria, alternative statistical and laboratory techniques, data availability/collectability, resource requirements, work schedule, and other factors. The objective of FMVSS 213 is injury reduction, to be achieved through specifying performance requirements for all child seats manufactured after 1 Apr 1971. These systems now undergo static tests approximating a 30 mph frontal crash, after which a torso block representing a child is measured for horizontal movement. FMVSS 213 is unique in that it applies to a regulated device which is an optional item, purchased by a relatively small percentage of the car-owning population. Accident statistics indicate about 1000 child deaths and 60,000 child injuries per year. Current estimates put the use of child seating systems at less than 10%, even though the actual number of child seats produced (about 7 million since 1971) is approximately 40% of the 0-5 child population (about 16 million). The plan described contains seven analyses. Mass accident data will be analyzed to determine if the use of child seating systems has resulted in a reduction in the number of deaths and severity of injury to young children. Detailed accident bases will be investigated for effects of various variables on injury to restrained and unrestrained children. Task three is a National Accident Sampling System (NASS) special data collection and analysis. Mail surveys of pediatricians and hospital emergency rooms will take place in the fourth task, and task five includes an on-site real world survey on the use of child restraints and a mail survey on attitudes toward these systems. Task six involves dynamic testing of commercial systems and the final analysis is of the direct costs of implementing FMVSS 213. Carrying out these tasks will take four years, at a total cost of \$781,000. If the on-site and mail survey and dynamic lab tests are not conducted under Tasks four and five, the entire study would be reduced to \$453,000. Appended are a copy of FMVSS 213, discussions of statistical techniques and of proposed standard implementation cost categories, proposed rule changes for

FMVSS 213, and a copy of the Tennessee Child Restraint Law, effective 1 Jan 1978.

by Kayla Costenoble; Gaylord M. Northrop  
Center for the Environment and Man, Inc., 275 Windsor St.,  
Hartford, Conn. 06120  
DOT-HS-7-01675  
Rept. No. CEM-4229-597; 1977; 143p refs  
Rept. for tasks 4 and 5. See also HS-803 388--HS-803 392 and HS-803 394.  
Availability: NTIS

HS-803 394

**FINAL DESIGN AND IMPLEMENTATION PLAN FOR  
EVALUATING THE EFFECTIVENESS OF FMVSS  
220: SCHOOL BUS ROLLOVER PROTECTION,  
FMVSS 221: SCHOOL BUS BODY JOINT STRENGTH,  
AND FMVSS 222: SCHOOL BUS SEATING AND  
CRASH PROTECTION. FINAL REPORT [FEDERAL  
MOTOR VEHICLE SAFETY STANDARD]**

The final design and implementation plan for evaluating the effectiveness of Federal Motor Vehicle Safety Standard (FMVSS) 220, School Bus Rollover Protection; FMVSS 221, School Bus Body Joint Strength; and FMVSS 222, School Bus Seating and Crash Protection, considers measurability criteria, alternative statistical and laboratory techniques, data availability/collectability, resource requirements, work schedule, and other factors. The objective of all three standards is to reduce the frequency and severity of injury in school bus accidents. FMVSS 220 and 221 establish requirements for the structural integrity of the bus, while FMVSS 222 relates to the bus interior. The effective date of the three standards is 1 Apr 1977. At present, there are little detailed data on school bus accidents making it difficult to evaluate pre-standard and post-standard effectiveness. New data will be required from detailed accident investigation teams such as Multidisciplinary Accident Investigation (MDAI) and National Accident Sampling System (NASS). Also school buses are manufactured at a relatively low rate (about 30,000/year) and it will take several years to accumulate sufficient accident data on post-standard vehicles. The plan described takes two general approaches: statistical analysis of available and future detailed accident data, and acquisition of new test and field data. To carry out these approaches, methodologies for five evaluation programs are presented. Two effectiveness evaluation programs involve straightforward processing of existing data and more detailed data which will be forthcoming. Two others call for acquiring laboratory and field data. The program for determining cost of the standards requires obtaining data from the manufacturers. It is estimated that the entire program would take about three years to complete at a cost of about \$1,268,000. Appended are copies of FMVSS 220, 221, and 222, and discussions of statistical procedures and of proposed standard implementation cost categories.

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Center for the Environment and Man, Inc., 275 Windsor St.,  
Hartford, Conn. 06120  
DOT-HS-7-01675  
Rept. No. CEM-4229-600; 1978; 70p refs  
Rept. for tasks 4 and 5. See also HS-803 388--HS-803 393.  
Availability: NTIS

HS-803 397

**TESTING AN IMPROVED FMVSS NO. 104  
WINDSHIELD WASHER PROCEDURE AND SPRAY.  
FINAL REPORT [FEDERAL MOTOR VEHICLE  
SAFETY STANDARD]**

An improved windshield washer test mixture, 8F test dirt formulation, was developed and the test procedure was updated to evaluate windshield washer performance using the new test mixture. The data obtained in this study are intended for use in revising the windshield washer compliance test procedures in future rulemaking involving Federal Motor Vehicle Safety Standard (FMVSS) 104, Windshield Wiping and Washing Systems. The improved test mixture consists of the following ingredients and proportions: 20 g Mineral Colloid BP (clay in fine particle form), 10 ml 2% aqueous Gelvatol 20-60 solution poly(vinyl alcohol) which adds tenaceous properties, 800 ml deionized water, and 3 g Ti-Pure R-900 (titanium dioxide) which adds a highly visible whiteness. As an option, 0.4 g Dowicide G, a preservative, can be added to the formulation to extend shelf life (estimated to be in excess of six months). The 8F formulation consists of low cost, readily available components that are easy to prepare. The mixture is easily applied with a hand sprayer and gives a uniform coating due to the good suspension properties of the solid components. The film is sufficiently difficult to remove to allow the identification of washer systems that perform poorly. Remaining test dirt film, after operating the washer/wiper system is readily visible, i.e. uncleaned areas can be easily identified. The test procedure is a modification of FMVSS 104, TP-104-04 procedure for testing windshield wiper and washer systems. The most significant change is the addition of a photometric technique to determine the amount of test dirt on the glazed surface.

by Roy W. Hull; Leon M. Adams; Clarke E. Schuetze  
Southwest Res. Inst., 8500 Culebra Rd., San Antonio, Tex.  
78284  
DOT-HS-6-01407  
Rept. No. SwRI-AR-1150; 1977; 61p  
Rept. for 1 Jul 1976-28 Feb 1977. See also HS-803 398.  
Availability: NTIS

HS-803 398

**EVALUATION OF DIRT FILMS, LAMPS AND  
PROCEDURES FOR HEADLAMP WASHER TESTS.  
FINAL REPORT**

Four dirt film formulations (SwRI (Southwest Res. Inst.)-developed 8F test dirt formulation, SAE test dirt formulation, Docket 69-19 test dirt formulation, and K11 (SAAB Smuts-spray) test dirt formulation) were evaluated for use in testing of headlamp washers. The evaluations were made using three different headlamp beam patterns (5-3/4 in U.S. type 2 Wagner lamp, 5-3/4 in tungsten halogen cycle H-1 Cibie lamp, and special 5-3/4 in uniform beam pattern lamp manufactured by Wagner) and four different sets of photometric test points (Docket 69-19 (H-V, 1-1/2D-2R, 1-1/2D-2L, H-5L, and H-5R), SAE (1/2D-1-1/2R, 1D-6L, 1-1/2D-9L, and 1-1/2D-9R), ECE (.9D-V and .9D-1.7R), and SwRI (1U-6R, H-V, 1D-6L, 1-1/2D-2R, and 1-1/2D-9R)). From results of this study, the 8F test dirt solution is recommended for use as a headlamp washer road film solution if used with the U.S. lower beam pattern or with a uniform pattern washer test headlamp. The 8F solution consists of the following ingredients and proportions: 20 g Mineral Colloid BP, 10 ml 2% aqueous Gelvatol 20-60 solution

poly(vinyl alcohol), 800 ml deionized water, 3 g Ti-Pure R-900, and 0.4 g Dowicide G (optional). A uniform pattern washer test lamp is recommended to provide an internationally acceptable beam pattern for performance testing headlamp washers. A set of photometric test points that are acceptable for U.S. and European headlamp washer tests are recommended as follows: 1U-6R, H-V, 1D-6L, 1-1/2D-2R, and 1-1/2D-9R. These test points are recommended regardless of the test lamp used. A revised headlamp washer performance standard (revision to headlamp washer standard presented in Docket 69-19; Notice 3, Section S7.10) is conditionally recommended. Prior to adapting the revised standard, it is recommended that the recovery factor specified be further evaluated to determine that when using the 8F test dirt solution (or other solution), the required recovery factor is properly chosen to pass good washer systems, yet high enough to screen out washer systems that are inadequate in performance. Finally, it is recommended that with the assistance of the U.S. lamp manufacturers, design and performance standards be established for a uniform pattern washer test headlamp equivalent to the lamp used by SwRI and called out for use in the recommended revised standards.

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78228  
DOT-HS-6-01407-Mod-2  
Rept. No. SwRI-AR-1205; 1977; 48p 1ref  
Rept. for 28 Feb-9 Sep 1977. See also HS-803 397.  
Availability: NTIS

HS-803 410

**EXPERIMENTAL FIELD TEST OF THE MODEL ICE  
CREAM TRUCK ORDINANCE IN DETROIT. FINAL  
REPORT**

Findings are presented of a two-year (1976 and 1977) field test of the safety-effectiveness of the Model Ice Cream Truck Ordinance (MICTO), a legal countermeasure designed to prevent child-pedestrian accidents from occurring near ice cream trucks, enacted by the City of Detroit on 12 May 1976 and fully effective on 10 Jun 1976. Among other things, the MICTO requires motorists to stop before passing an ice cream truck displaying the special swing arm and flashing lights which must be actuated when the truck is stopped to vend. Results for 1976 show that radar-measured average motorist speed abreast of vending ice cream trucks was reduced from 28.10 mph before the MICTO to 15.65 mph after the MICTO, a 44% reduction. During the 1 Jul-31 Oct 1976 period, vendor-related child-pedestrian accidents were reduced from a three-year average of 19.67 prior to the MICTO to 9 after the MICTO, a 54% reduction. In 1977, average motorist speed at the truck continued at a reduced level of 15.79 mph. However, vendor-related child-pedestrian accidents were lowered from a 1973-1975 pre-MICTO average of 48.67 to 11 in 1977, a 77% reduction.

by Allen Hale; Richard D. Blomberg; David F. Preusser  
Dunlap and Associates, Inc., One Parkland Drive, Darien,  
Conn. 06820  
DOT-HS-5-01144  
1978; 109p 5refs  
Rept. for Jun 1975-Mar 1978.  
Availability: NTIS

HS-803 411

# **INSTRUCTOR TRAINING INSTITUTE FOR NHTSA CURRICULUM PACKAGE: EMERGENCY MEDICAL TECHNICIAN-DISPATCHER. FINAL REPORT**

In order to assist states in making the National Hwy. Traffic Safety Administration's (NHTSA) EMT (Emergency Medical Technician)-Dispatcher curriculum package operational, four three-day instructor training courses were developed and conducted. The curriculum package consists of a course guide prepared to aid the training administrator in planning, managing, and evaluating the course; an instructor lesson plans document and set of training aids designed to assist the instructor in the day-to-day conduct of each course lesson; and a student study guide designed as an aid to the student in achieving course objectives. The purposes of conducting the instructor training institutes were to introduce and explain the curriculum package and to provide training in instructional methods and techniques appropriate to the package. The study also included selection and orientation of instructors, selection of institute sites and dates, all local arrangements, enrollment of attendees, and management of evaluation of each institute program. Additionally involved was the development of training aids to support the EMT-Dispatcher curriculum package; the resultant 2x2 35 mm slides and audio tapes were also introduced at the institutes. Institutes were held in the fall of 1977; instructors were faculty members from Central Connecticut State College who were authorized to conduct the course for college credit. Host colleges (Central Connecticut, Univ. of Michigan, Univ. of West Florida, and Colorado State Univ.) were selected for their interest and capabilities relative to highway safety instructor training. Each college provided a representative to monitor the program; each thus has an in-place capability to respond to future requests for EMT-Dispatcher instructor training. Forty-nine individuals attended the program; they represented 42 states, the District of Columbia, and the U.S. Coast Guard. Attendees expect their organizations will use all or some of the EMT-Dispatcher curriculum materials in their future dispatcher training efforts. Attendee opinions regarding institute content and conduct were positive.

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Dunlap and Associates, Inc., One Parkland Drive, Darien,  
Conn. 06820  
DOT-HS-6-01513  
1977; 81p 1ref  
Rept. for Jun 1976-Nov 1977.  
Availability: NTIS

HS-803 412

# **EXTENSION OF ALABAMA MOTOR VEHICLE DIAGNOSTIC INSPECTION DEMONSTRATION PROJECT. AUTO CHECK VOL. 1. FINAL REPORT**

Information and data are presented which were derived from the original Diagnostic Inspection Demonstration Project (Nov 1974-30 Jun 1976), the interim period supported by University of Alabama in Huntsville (UAH) (1 Jul-31 Dec 1976) and the extension of the original project (1 Jan 1977-30 Sep 1978) together with the several analyses of that data. The diagnostic inspection program was found to be practical and beneficial; it should be mandatory, operated by state employees or a state inspection contractor forbidden to make repairs or recommend repair shops. Funding could be from an added vehicle license tag tax or similar measure. Inspection should be performed annually; repair of mandatory safety defects should be accom-

plished and verified within 30 days. Major conclusions were that the consumer can communicate better with the repair facility if he has the specific repair instructions in hand (the Prescription Forms). In the first phase of the program, 26% of all engine, brake, steering alignment, and suspension repairs were unnecessary; after the participants were given Prescription Forms the unnecessary repair rate was reduced to 13%. The gain from a diagnostic inspection in reduction of accidents is estimated to be 10%. Continuation of the collection of automotive data through the diagnostic project is urged. Appended are tables of systems outage rates by model year and periodic inspection, component outage rates for each of the 106 inspected items by model year by periodic inspection.

by Albert L. Castelli; Joseph F. Peters; William F. Peyton; Bernard J. Schroer; M. C. Ziemke  
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DOT-HS-5-01056-Mod-10  
Rept. No. UAH-213; 1978; 127p  
Includes appendices A-D; appendices E-O comprise HS-803 413. Rept. for 1 Jan 1977-14 Apr 1978.  
Availability: Reference copy only

HS-803 413

# **EXTENSION OF ALABAMA MOTOR VEHICLE DIAGNOSTIC INSPECTION DEMONSTRATION PROJECT. AUTO CHECK VOL. 2. (APPENDICES E-O) FINAL REPORT**

An evaluation is made of repair costs of vehicles participating in the Alabama Auto Check automotive diagnostic inspection facility, first classifying the costs into necessary and unnecessary repairs and then comparing and analyzing any differences in costs by owner demographics (primarily sex), repair shop classifications, and Auto Check information groups (control and experimental). A total of 3567 repair actions were analyzed, representing \$76,532 in repairs to 2062 vehicles. A substantial decrease was detected in the rates and costs of unnecessary repairs during the Auto Check program. Data are presented on overall repair rates and costs, the effects of learning on unnecessary repair rates and costs, engine, brake, alignment and suspension repairs, and market share for various repair facility types. Also included are: evaluations of vehicle and component repair costs for Auto Check participants; the effects of additional consumer information on unnecessary automobile repairs; the quality of automotive repairs for Auto Check participants; a comparison of the accident rates of Auto Check vehicles versus uninspected vehicles; the effects of automobile inspections on accident rates; vehicle exhaust emissions on initial inspection; the effects of vehicle mileage on component outage rates; annual vehicle repair and maintenance costs for Auto Check participants; a critique of brake drum turning procedures and practices; and brake inspection strategies.

by Albert L. Castelli; Joseph F. Peters; William F. Peyton; Bernard J. Schroer; M. C. Ziemke  
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DOT-HS-5-01056  
Rept. No. UAH-197; UAH-201; UAH-208; UAH-209; UAH-202; UAH-210; UAH-211; UAH-212; UAH-207; 1978; 778p  
29refs  
Vol. 1 is HS-803 412.  
Availability: Reference copy only

### **RSV PHASE 3. BIMONTHLY PROGRESS REPORT, FEBRUARY/MARCH 1978 [RESEARCH SAFETY VEHICLE]**

The progress Minicars made on the Research Safety Vehicle (RSV) Phase 3 program during the seventh bimonthly reporting period is described. The report is organized into task sections (program plan, program status reviews, product improvement of inflatable restraints, structural refinement, systems refinement, plastic material improvement, electronics, braking and handling, compatibility analysis, high technology engine/transmission, structures fabrication, systems fabrication, accident/benefit analysis, large RSV (LRSV), production planning, and tooling); in each section, task progress is summarized to the subtask level. Subcontractor progress reports are included as appendices. The fiscal status reports are under separate cover. The only area of noncompliance in performance tests was that of ride frequencies; stiffer ride frequencies are characteristic of smaller cars in comparison with larger ones. The suspension bottoming in earlier tests has been eliminated by the correct installation of the suspension struts. The slightly changed vehicle weight and weight distribution have not appreciably affected RSV performance, nor have the modified steering column angle and resultant linkage changes.

Minicars, Inc., 55 Depot Rd., Goleta, Calif. 93017  
DOT-HS-7-01552  
Rept. No. PR-Feb/Mar-78; 1978; 135p 3refs  
Availability: Corporate author

HS-803 455

### **EVALUATION OF RESEARCH ON SURROGATES FOR HUMANS IN MOTOR VEHICLE CRASHES**

Specific categories of research which were examined and assessed include the following: the National Hwy. Traffic Safety Administration (NHTSA) approach to the development of anthropomorphic dummies with respect to NHTSA's goals and within the context of NHTSA's legal and engineering prerogatives and responsibilities; ability of this program to achieve NHTSA's goals; utility of human cadaver testing or other major testing modes on the quality and timeliness of achieving these goals; alternative approaches that are considered to be capable of producing feasible, timely, and practical solutions to the problem of anthropomorphic dummy development; and adequacy of procedures for acquisition and description of medical data, engineering data, and analytical procedures, and alternative procedures that might permit the elimination of cadaver research. The continuation of research toward the development of increasingly crashworthy motor vehicles should be actively and aggressively pursued. The three general areas in which substantial continuing research is required are the driving behavior of the American public, highway safety engineering, and modification of motor vehicles to improve their crashworthiness and to increase the quality of their safety systems to reduce death and injury. The approach to vehicular modification cannot be confined to any one methodology. Methods that must be employed include the following: retrospective field analyses of accidents; studies with volunteers at levels of dynamic loading that produce no or minimal injuries; development of more realistic anthropomorphic dummies to be used in crash tests for vehicle development and certification; studies with human cadavers to

provide a basis for surrogate development and validation; studies with animals, both living and cadaveric; and mathematical modeling. Consideration should be given to the development of programs to instrument significant numbers of production motor vehicles to obtain more accurate and useful data on the physical characteristics of crashes that occur in everyday use. Consideration should be given to the development of programs that will place specifically-modified and selectively-modified motor vehicles in the hands of the driving public to evaluate the effects of such modifications on safety. To provide a data base for the development of anthropomorphic dummies and injury criteria, the use of human cadavers is necessary and should be continued. Human cadaveric studies are deemed necessary in vehicle crash tests for which current dummies are insufficient. The use of cadavers must continue to be limited to necessary experimentation that is conducted under ethical guidelines that preserve the dignity and privacy of the human body.

National Acad. of Sciences, Com. on Evaluation of Res. on  
Surrogates for Humans in Motor Vehicle Crashes,  
Washington, D.C.  
DOT-HS-8-01948  
1978; 50p 40refs  
Availability: Corporate author

HS-803 672

### **DATA AND ANALYSIS FOR 1981-1984 PASSENGER AUTOMOBILE FUEL ECONOMY STANDARDS. DOCUMENT 1. AUTOMOBILE DEMAND AND MARKETING**

The purpose of these support documents is to provide a substantive data base, plus analysis and judgments relevant to the establishment of average fuel economy standards for model years 1981 through 1984. The consideration of economic practicability in determining maximum feasible fuel economies, required by the Energy Policy and Conservation Act, involves auto sales levels; they are a measure of consumer reaction to the fuel economy standards and a major determinant of the financial condition and economic health of the U.S. economy. Issues of auto supply and demand are considered separately. An analysis of auto demand considers historical trends, projections of "baseline" auto demand, determinants of auto demand, sales by size class, and import penetration. An analysis of auto industry marketing and pricing strategies includes competitive characteristics and strategy within the industry, specifically for General Motors, Ford, Chrysler and American Motors, product mix and product sales projections, industry revenues, kinds of customers with factors affecting car choices and the profile of new car buyers, advertising, auto distribution of franchises and dealerships, sales promotion and sales training. A discussion of industry pricing procedures describes the application of standard volume pricing by General Motors, comparing this with pricing methods at Ford, Chrysler, and American Motors. Information on future pricing of small domestic cars, in view of the devaluation of the U.S. dollar, and on adjustment of prices to cover extra costs for changes made to meet government fuel economy regulations is not yet available. Appendices provide a review of auto demand models, tables of new car registrations covering years from 1947 to 1974 in several categories, preliminary model forecasts for auto demand related variables, and tables indicat-

ing sales and revenues of the industry for 1975 and 1976 by specific size class and model.

National Hwy. Traffic Safety Administration, Office of Automotive Fuel Economy; Transportation Systems Center, Cambridge, Mass.

1977; 229p 39refs

See also HS-803 673--HS-803 678.

Availability: NHTSA

HS-803 673

**DATA AND ANALYSIS FOR 1981-1984 PASSENGER  
AUTOMOBILE FUEL ECONOMY STANDARDS.  
DOCUMENT 2. AUTOMOTIVE DESIGN AND  
TECHNOLOGY. VOL. 1**

This document provides automotive design and technology data and analyses in support of the Summary Report. Projected changes in passenger car components are discussed and resultant fuel economies for each domestic manufacturer computed by year. The projected changes are organized in three alternatives, each representing different combinations of technological improvements and varying technological risks. The first, with lowest risk, involves weight reduction by redesign only, with no major material substitution; engine improvement of 4% to 8%; and automatic transmission improvement of 4% to 5.5% by the addition of torque converter lock-up clutch in standard three-speed automatics. The second alternative, with more technological risk, provides weight reduction by redesign and major material substitution; engine improvements of 10%; automatic transmission improvement of 10% by the addition of a fourth gear and torque converter lock-up; and miscellaneous improvements of 4%. The third alternative, with highest technological risk, is the same as the second, but with the addition of diesel engine penetration in the heavier models (25% penetration maximum). In all cases, consumer attributes are maintained constant and, generally, existing engines are used. Emission penalties for the three alternatives are given in a table. Further supplementary data are appended.

National Hwy. Traffic Safety Administration, Office of Automotive Fuel Economy; Transportation Systems Center, Cambridge, Mass.

1977; 190p 20refs

See also HS-803 672 and HS-803 674--HS-803 678.

Availability: NHTSA

HS-803 674

**DATA AND ANALYSIS FOR 1981-1984 PASSENGER  
AUTOMOBILE FUEL ECONOMY STANDARDS.  
DOCUMENT 2. AUTOMOTIVE DESIGN AND  
TECHNOLOGY. VOL. 2 [APPENDIX D]**

Supplemental tables are provided for the three alternatives of projected changes in passenger automobile components. Alternative 1 includes weight reduction due to body redesign, selection of efficient spark ignition engines, low risk technology improvements to spark ignition engines, and addition of torque converter lock-up clutch to automatic transmissions. Alternative 2 includes weight reduction due to body redesign and material substitution, selection of efficient spark ignition engines, technology improvements to spark ignition engines, addition of torque converter lock-up clutch and fourth gear to automatic transmissions, and other improvements, lubricants,

and accessories. Alternative 3 is the same, but includes penetration of diesel engines into the fleet and technology improvements to diesel engines. A further alternative provides a 5% emission penalty for spark ignition engines and no emissions penalty for diesel engines.

National Hwy. Traffic Safety Administration, Office of Automotive Fuel Economy; Transportation Systems Center, Cambridge, Mass.

1977; 218p

See also HS-803 672--HS-803 673 and HS-803 675--HS-803 678.

Availability: NHTSA

HS-803 675

**DATA AND ANALYSIS FOR 1981-1984 PASSENGER  
AUTOMOBILE FUEL ECONOMY STANDARDS.  
DOCUMENT 2. AUTOMOTIVE DESIGN AND  
TECHNOLOGY. VOL. 2. ADDENDUM 1. APPENDIX  
D5**

This appendix supplements Appendices D1 through D4 of the Automotive Design and Technology Document, Vol. 2 of 28 Feb. 1977, and should be considered as part of the Summary Report and Supplementary Documents dated 28 Feb 1977. The D5 Base Case for Model Years 1981-1985 includes weight reduction due to body redesign and material substitution, and selection of efficient spark ignition engines.

National Hwy. Traffic Safety Administration, Office of Automotive Fuel Economy; Transportation Systems Center, Cambridge, Mass.

1977; 68p

See also HS-803 672--HS-803 674 and HS-803 676--HS-803 678.

Availability: NHTSA

HS-803 676

**DATA AND ANALYSIS FOR 1981-1984 PASSENGER  
AUTOMOBILE FUEL ECONOMY STANDARDS.  
DOCUMENT 3. AUTOMOBILE MANUFACTURING  
PROCESSES AND COSTS**

Manufacturing processes and basic concepts are discussed in general terms and with reference to American Motors, Chrysler, Ford, and General Motors. The impact on manufacturing facilities and tooling that the implementation of various kinds of product changes require is considered. A description is included of the manufacturing facilities, the capital expenditures and lead time required to build and to modify the manufacturing facilities, with a description of the production rates and production volumes for vehicle engines, transmissions, and other components. Changes in the variable cost of the vehicles of various configurations and the cost of components which may be added or deleted from the vehicles by the manufacturer in order to produce a vehicle with improved fuel economy are estimated. Assessments are appended of lightweight body materials, lightweight diesel, dual catalytic converter system, fuel injection, and automatic transmissions. Also appended are analyses of the cost of 4th gear components, of the lock-up system, and of automatic transmission gearing.

National Hwy. Traffic Safety Administration, Office of Automotive Fuel Economy; Transportation Systems Center, Cambridge, Mass.

1977; 288p

See also HS-803 672--HS-803 675 and HS-803 677--HS-803 678.

Availability: NHTSA



HS-803 677

**DATA AND ANALYSIS FOR 1981-1984 PASSENGER  
AUTOMOBILE FUEL ECONOMY STANDARDS.  
DOCUMENT 4. FINANCIAL ANALYSIS OF THE U.S.  
AUTOMOTIVE MANUFACTURERS**

An analysis is made of the possible impacts of the Automotive Fuel Economy Regulations (AFER) program on the corporate financial position of the four principal U.S. automobile manufacturers: General Motors Corp., Ford Motor Co., Chrysler Corp., and American Motors Corp. (AMC). From this analysis the prospects are assessed for successful accommodation of these companies to the new fuel efficiency requirements. Possibilities of major financial difficulties are also considered. A conceptual framework sets forth the financial strengths of the companies; historical patterns in the financial structure and capital financing of the companies are compared with trends in U.S. financial markets, and with general trends in capital spending; the specific capital needs of AFER are considered in relation to projections of the four companies' ongoing capital expenditures; several alternatives by which they could meet these capital needs are examined; and the effects of the penalty charges are discussed. AFER-related projects would add between 10% and 16% to the companies' normal capital expenditures for tooling and plant and equipment between 1979 and 1984, depending on the alternatives chosen. However, the recent recession, combined with a longer-term deterioration in auto industry profits, has left two companies, Chrysler and AMC, in a position from which it would be difficult to raise new capital funds. Possible strategies for reducing or avoiding extraordinary expenditures might include purchasing key components from outside suppliers or selectively withdrawing low-efficiency models from their product lines. Appended is an analysis of manufacturers' balance sheets and sources and uses of funds statements.

National Hwy. Traffic Safety Administration, Office of Automotive Fuel Economy; Transportation Systems Center, Cambridge, Mass.

1977; 64p

See also HS-803 672--HS-803 676 and HS-803 678.

Availability: NHTSA

HS-803 678

**DATA AND ANALYSIS FOR 1981-1984 PASSENGER  
AUTOMOBILE FUEL ECONOMY STANDARDS.  
SUMMARY REPORT**

The report presents technical, economic, and other data and analyses relevant to the consideration of fuel economy standards for the passenger automobile in model years 1981-1984. Because of the depth and complexity of the issues, a number of simplifying assumptions have been made in this summary report analysis, both with regard to the technological options and the impacts of these options on the national economy, the consumer, and the industry. The report provides a data base relevant to the analysis of the problem of determining maximum feasible average fuel economy levels. First it presents a general evaluation of the impacts and potential for improved auto fuel economy, including an overview of the nation's need to conserve energy and the trend to increased petroleum imports, an evaluation of petroleum conservation, an evaluation of auto fuel economy improvement potential, a consideration of economic and other impacts on the consumer, national economic and other impacts, and the potential economic im-

part of the introduction of improved automobile fuel economy on the auto manufacturers. The second part of the report projects the impact of the introduction of improved fuel economy technology on the product planning/marketing, financial and manufacturing/engineering strategies and tactics of each of the domestic auto manufacturers. It includes comparisons between the manufacturers' projections of 1980/1985 new-car fleet fuel economy (based on their Nov/Dec 1976 submissions to the DOT/NHTSA Advanced Notice of Proposed Rule Making on the Passenger Automobile) and those of DOT/NHTSA.

National Hwy. Traffic Safety Administration; Transportation Systems Center, Cambridge, Mass.

1977; 172p 15refs

See also HS-803 672--HS-803 677.

Availability: NHTSA

HS-810 311

**STATEMENT BEFORE THE SENATE COMMITTEE  
ON GOVERNMENTAL AFFAIRS, SUBCOMMITTEE  
ON GOVERNMENTAL EFFICIENCY AND THE  
DISTRICT OF COLUMBIA, DECEMBER 6, 1977 [AIR  
BRAKES]**

Monitoring of Federal Motor Vehicle Safety Standard No. 121, Air Brakes, by the National Hwy. Traffic Safety Administration (NHTSA), the safety consequences of the standard, and the issue of reestablishing "no lockup" stopping performance requirements for air-braked buses are addressed. Available evidence indicates that, prior to the implementation of FMVSS 121, the braking performance and poor vehicle control of heavy trucks during braking and turning maneuvers were substantial causes of heavy vehicle involvement in accidents. While passenger cars provide stopping distances of 165 to 200 feet from 60 mph on a dry surface, heavy trucks built before implementation of FMVSS 121 were stopping in 330 to 350 feet, some taking as much as 450 feet. The standard was put into effect in Jan 1975 for trailers and Mar 1975 for trucks and buses, giving manufacturers approximately four years to prepare for compliance. Following implementation, several adjustments of the requirements were effected. The remaining major controversy is over feasibility of the standard's "no lockup" requirement, that the vehicle be capable of coming to a stop under specified conditions without the wheels locking uncontrollably. The "no lockup" requirement is typically met by installation of antilock systems. A study sponsored by the Dept. of Transportation (DOT) shows an approximate 20% accident reduction for 121-equipped vehicles, based on the safety records of air-braked trucks built before and after the standard's implementation. Other data collected of a more qualitative nature support the view that the standard is proving significantly beneficial. In Apr 1977, NHTSA appointed a task force to collect and evaluate information about the "no lockup" requirement of the air brake standard (a list of its ongoing activities is provided following the discussion). A public hearing on the safety and cost consequence of the "no lockup" requirement is to be held on 15 Dec 1977, the forum designed to bring out conflicting assertions of users and manufacturers about field experience with the standard.

by Joan Claybrook

National Hwy. Traffic Safety Administration, Washington, D.C. 20590

1977; 13p

Availability: Corporate author



HS-810 313

**STATEMENT BEFORE THE SUBCOMMITTEE ON CONSUMER, SENATE COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION, CONCERNING AUTHORIZATIONS FOR THE IMPLEMENTATION OF THE HIGHWAY SAFETY ACT OF 1966, APRIL 7, 1978**

A bill to provide authorizations for fiscal years 1979-1982 for the implementation of highway safety programs, S. 2541, in relation to the National Hwy. Traffic Safety Administration's (NHTSA) role in this area and its plans for the future, is discussed. S. 2541 would strengthen NHTSA's state highway safety programs by encouraging states to identify and pursue programs which are most suitable to their needs. The bill also earmarks funds to support high priority programs such as the 55 mph national speed limit. NHTSA realizes that the time has come to shift the emphasis of its highway safety program towards the states' involvement in developing solutions to their safety problems. S. 2541 proposes to restrict the areas in which nationwide uniformity in highway safety standards will be required to a very small number and to place a proportionally greater emphasis on the states' need to identify their problems, devise solutions, and evaluate the results. Uniform requirements would be retained in two key areas; first, data collection and analysis as related to traffic records, driver licensing, and vehicle registrations; and second, those areas which facilitate safe interstate travel, such as uniform rules of the road and traffic control devices. The bill also provides for the strengthening of the state agency responsible for coordinating the statewide highway safety program. The bill would establish a program of innovative project grants in place of the present program of incentive awards which are based on annual reductions in fatalities and fatality rates in each state. It is believed that this change provides a more direct motivation to the states to improve their highway safety programs and provides encouragement to experiment. Up to 25% of funding authorized for the state and community highway safety program would be separately apportioned for high priority safety programs, such as increased enforcement of the national speed limit. Under a four-step compliance schedule, partial loss of non-Interstate highway construction funds of up to 5% for FY's 1980-1982 and up to 10% for FY 1983 and each succeeding fiscal year thereafter, would occur for any state's failure to reduce actual speeds in accordance with speed compliance goals. Lost funds would be apportioned to the state if compliance improved to the level specified during the applicable fiscal year.

by Howard Dugoff  
National Hwy. Traffic Safety Administration, Washington,  
D.C. 20590  
1978; 6p  
Availability: Corporate author

HS-810 315

**STATEMENT BEFORE THE NATIONAL AUTOMOBILE THEFT BUREAU'S ANNUAL MEETING IN CHICAGO, ILLINOIS ON MARCH 28, 1978**

The creation in 1966 of a Federal agency concerned with highway safety led to higher standards of motor vehicle safety and, in the past four years, a leveling off of the death and injury tolls. The problems of fraud, theft, and inadequate and

deceptive automotive repair practices are being dealt with by programs designed to protect consumers. The practice of rolling back odometers is being combated in several ways: by cooperation with the Justice Dept.; by a ruling requiring retention for four years of copies of odometer statements received or issued by dealers; by a new standard setting requirements for the installation and accuracy of speedometers and odometers, limiting the speed which can be indicated on a speedometer to 85 mph; requiring that odometers be tamper-resistant and indicate when a vehicle's cumulative mileage exceeds 100,000 miles. NHTSA's auto theft prevention program introduced requirements for passenger car locks and a vehicle identification number (VIN). The Interagency Com. on Auto Theft Prevention was established in 1975, with representatives from a number of Federal agencies. An amendment has been introduced to provide an improved and uniform Vehicle Identification Number (VIN) code and location to simplify data retrieval and identification, requiring a VIN to identify uniquely each vehicle for a 30-year period. Another proposed rule would require separate keys for door and ignition, modification of door locks and hood latches, protection of ignition wires, and continuation of the alarm when the key is left in the ignition with the engine off. As the reselling of vehicle parts is very profitable, theft for this purpose has increased in recent years. A uniform approach by the states is urged for the areas of titling of salvage motor vehicles, regulating the processing of the used major components of salvage vehicles, and prohibiting the removal, defacing, or alteration of any identification affixed by the manufacturer. Further legislation is pending to provide criminal penalties for removing VIN's, utilizing the mails to advertise and sell theft devices, and dismantling stolen vehicles; illegal operation as well as vehicles which have had their identification numbers removed, would be subject to Federal confiscation.

by Joan Claybrook  
National Hwy. Traffic Safety Administration, Washington,  
D.C. 20590  
1978; 16p  
Availability: NHTSA

HS-810 316

**REMARKS BEFORE OPERATION CARE [COMBINED ACCIDENT REDUCTION THROUGH ENFORCEMENT] MEETING, INDIANAPOLIS, INDIANA, MARCH 28, 1978**

Combined Accident Reduction through Enforcement (CARE) is a cooperative program, generated by the states involved, to enforce traffic laws nationwide. One result of the effort is emphasizing to the public the commitment of leadership to making the 55 mph speed limit work. Enforcement of the speed limit along Interstate highways among the cooperating states is especially effective. An opportunity is provided to deal with the out-of-state motorist, responsible in many states for nearly half of the speeding arrests. Through CARE, a network is established to deal more effectively with the lack of uniform emphasis on the speed limit among the states; joint planning and decisionmaking are stimulated so that enforcement activity and policies are mutually reinforcing. Surveys show that the American driver favors the law; this positive reaction is encouraging even though speeding still occurs. People feel they are in compliance with the "spirit" of the lower speed law when driving at 55 plus an extra few miles per hour; an extra effort of enforcement may gradually nudge them to lower speeds. A survey in California showed that a reduction

of only one mile per hour in the average speed results in a saving of approximately 40 lives per year. Currently, the enforcement presence (visibility of police, sophisticated mobile radar equipment, and the unpredictable movement of patrols) still affords the most effective means for achieving voluntary public compliance. In a few more years, a significant portion of the driving population will never have known a speed limit higher than 55 mph; when it becomes routine for the majority, it will cease to be an issue.

by Joan Claybrook  
National Hwy. Traffic Safety Administration, Washington,  
D.C. 20590  
1978; 6p  
Availability: NHTSA

HS-810 317

### **VEHICULAR HOMICIDE -- THE FORGOTTEN CRIME [ASAP'S]**

A series of Alcohol Safety Action Programs (ASAP's) around the country from 1970 to 1976 fostered enactment of laws making it easier to apprehend and arrest the driving while intoxicated (DWI) offender; treatment and rehabilitation have become a permanent feature of the health and highway safety fields. Vehicular homicide prosecutions are few; the reluctance of judges and juries to convict under manslaughter statutes has led to negligent homicide charges, a lesser offense with lower maximum penalties. There is serious culpability of surviving drivers in fatal crashes but ineffectualness of prosecution and deterrence in these cases. The alcohol-involved vehicle is likely to be the "striking vehicle" in multiple vehicle crashes, with excessive speed also a factor. A profile of the driver who was drinking and responsible for the crash showed a male who probably had a previous DWI arrest, two or more speeding violations, a suspended or revoked license at the time of the crash, and was a heavy social or problem drinker. The deplorable condition of vehicular homicide laws and lack of prosecution under them permits such a "career traffic offender" to continue unchecked. Present development of a National Accident Sampling System will produce a probability sample of the nation's accidents that will yield statistics with known error bounds. Concomitant with the transition to multi-site investigative systems has been the development of mathematical models for accident reconstruction. The need for effective action against the serious and chronic traffic offender requires the commitment of specially trained personnel and revision of the criminal laws to promote prosecution of the offending driver.

by Joan Claybrook  
National Hwy. Traffic Safety Administration, Washington,  
D.C. 20590  
1978; 15p  
Remarks before the First Vehicular Homicide/DWI Conference, sponsored by Northwestern Univ. Traffic Inst. and National District Attorneys' Assoc., Chicago, Ill., 3 Apr 1978.  
Availability: NHTSA

HS-810 318

### **CONSTITUENCIES: DO REGULATORY AGENCIES NEED THEM?**

Although regulatory agencies exist to protect the public interest against business predators, the primary influence over

regulatory decisions is wielded by the regulated industries. The defeat of the Consumer Protection Agency bill is an example of this influence. The automobile industry has the resources to monitor almost every move taken by the regulatory agency and a substantial ability to oppose unwelcome policies. While the public's concern can affect regulatory agencies' policies, as recently demonstrated in improved safety standards for school buses and fuel systems, there is still a lack of participation by the public in debate and decisionmaking. Much information and help can be provided by state and local police groups, the medical community, insurance companies, educators, inventors and suppliers, and labor unions--a broad constituency for auto safety. A program is outlined to foster this participation, including early publication of proposed rulemaking to permit discussion; use of polls to guide agency priorities; public participation programs; public hearings; educational forums on specific topics; personal visits to communities by top agency officials; making officials accessible to the public through radio, TV, and public appearances; telephone Auto Safety Hotlines; and publication of technical information in a simplified form. The backing of active citizens' groups throughout the country is needed to promote the public's self-interest before regulatory agencies.

by Joan Claybrook  
National Hwy. Traffic Safety Administration, Washington,  
D.C. 20590  
1978; 10p  
Remarks before Women's National Democratic Club, 13 Apr 1978.  
Availability: NHTSA

HS-810 319

### **REMARKS BEFORE THE AUTOMOTIVE SALES COUNCIL ANNUAL MEETING, KEY LARGO, FLORIDA, APRIL 7, 1978**

Major changes presently occurring in the automobile industry are affected by rising prices, threats of shortages of both petroleum and construction materials, by the public demand for greater safety, cleaner air and energy conservation, and by inflation and reduced economic growth. New technologies, design, and engineering concepts and materials applications are being adopted, including such developments as air bags, three-way catalysts for exhaust emission control, the beadless tire, four-speed lock-up transmission, turbo-charging of both gasoline and diesel engines, and improved structures for crash energy management. Computer technologies have had a revolutionary effect; changing exchange rates are increasing competition by foreign manufacturers. The demand is increasing that cars be designed so that they can be diagnosed and repaired accurately and at reasonable cost; waste in the automotive repair industry poses a challenge to the automobile parts industry. The supplier industry should provide help to automakers in meeting new, more stringent requirements for safety and fuel economy. While standards are set for many aspects of new vehicle performance, such standards apply to only a limited number of aftermarket components: hydraulic and air brake hoses, lamp and reflecting devices, brake fluid, new retreaded passenger car tires, and seatbelt assemblies. Aftermarket replacement components for brakes are not yet regulated. Replacement components affecting a vehicle's fuel efficiency should also be up to the quality and performance of the original. Safety defect recalls, of which a number are cited, result in major expenses for the government as well as for the manufacturer or importer of the defective equipment;

January 31, 1979

HS-810 321

an importer of such equipment is as responsible for notification and recall as a domestic manufacturer. Polls show a high expectation by the public of a strong Federal safety and fuel economy program. A five-year rulemaking plan was published in the Federal Register on 14 Mar; public comment on this and other activity by the National Hwy. Traffic Safety Administration is invited.

by Joan Claybrook  
National Hwy. Traffic Safety Administration, Washington,  
D.C. 20590  
1978; 15p  
Availability: NHTSA

HS-810 321

**STATEMENT AT DIESEL WORKSHOP, APRIL 28,  
1978**

Significant energy savings are potentially available with greatly expanded use of diesel engines in light-duty vehicles. Estimated daily fuel savings by the year 2000 ranges from 300,000 to 900,000 barrels. However, adverse effects on human health are possible from diesel engine emissions that are now unregulated; namely, particulate emissions. Positive findings of mutagenicity in the Ames salmonella test could possibly be followed by findings of carcinogenicity in more elaborate health effects studies. A predicted increase in industrial capability to produce diesel engines for light-duty vehicles could result in a significant percentage (25%) by 1985. Until more complete information is obtained about risks to human health, and more effective techniques developed in controlling particulate emissions, the policy of the National Hwy. Traffic Safety Administration will continue to be the setting of fuel economy standards for passenger automobiles and light trucks at levels that do not require use of diesel engines.

by Joan Claybrook  
National Hwy. Traffic Safety Administration, Washington,  
D.C. 20590  
1978; 3p  
Availability: NHTSA

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